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PUBLICATIONS

OF THE

FIELD MUSEUM OF NATURAL HISTORY

ZOÖLOGICAL SERIES

VOLUME XI

CHICAGO, U. S. A.

1912

FIELD MUSEUM OF NATURAL HISTORY.

PUBLICATION 153.

ZOÖLOGICAL SERIES. VOL. XI.

THE MAMMALS OF ILLINOIS AND WISCONSIN

BY

CHARLES B. CORY

Curator of Department of Zoölogy.

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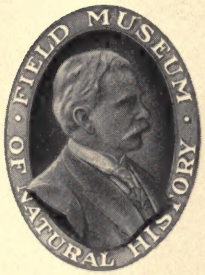

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PREFACE.

The present work includes, so far as known, all the living mammals which have been found in Illinois and Wisconsin, and gives descriptions of the various species and subspecies, with more or less of their life histories, together with maps illustrating their supposed geographical distribution. To increase its usefulness, brief synopses of all the known species and subspecies, belonging to our genera, which occur in eastern North America, are given and their distribution is indicated in the maps.

While it is hoped it will prove a useful book of reference for the specialist, it has been written with special regard to the needs of the layman, for, without departing from scientific lines, I have endeavored to make it as non-technical and popular in character as a serious consideration of the subject would permit.

With this object in view, for the purpose of simplifying identification of the various species belonging to a family, they are, wherever possible, arranged in the keys in groups based upon external characters which may be readily recognized by the lay reader, often regardless of their genera and not serially in their proper order as they are treated in the text. In a few cases, however, positive identification of a species depends upon dental characters which, while usually well-marked, are sometimes (as among the Shrews) too small to be seen with the naked eye. The student should therefore provide himself with a strong lens for the purpose.

At the present time 94 species and subspecies of mammals have been recorded from Illinois and Wisconsin, and probably several more will in time be added to the list. Such species as Dyche's Harvest Mouse (*Reithrodontomys dychei*), Little Meadow Mouse (*Microtus minor*), Woodland Jumping Mouse (*Napæozapus insignis*), Prairie Spotted Skunk (*Spilogale interrupta*), Big-eared Bat (*Corynorhinus macrotis*) and Free-tailed Bat (*Nyctinomus depressus*), have been taken in such nearby localities that there is little doubt that most of them will ultimately be found to occur within our limits.

Those who desire to study our mammals will be interested to learn that a considerable number may still be found in a wild state in the public parks of Chicago. In Jackson Park alone I have seen the following fifteen species: Northern Gray Squirrel, Striped Ground

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Squirrel or "Gopher," Northern White-footed Mouse, Meadow Mouse, Muskrat, House Mouse, House Rat or Norway Rat, Cotton-tail Rabbit, Mink, Common Shrew,* Short-tailed Shrew,* Prairie Mole,* Silver-haired Bat,* Red Bat,* and Hoary Bat.* In addition to these there is a specimen of the Raccoon in this Museum, which was killed in Jackson Park in 1898, and I am informed that Chipmunks, a Skunk and a Weasel have been seen.

In preparing the present work the majority of specimens examined are in the collection of the Field Museum of Natural History; but in addition to these a large number were loaned to me by other Museums and private collectors. In this connection I wish especially to express my thanks to Dr. C. Hart Merriam and Mr. H. W. Henshaw, U. S. Biological Survey, Washington; Dr. J. A. Allen and Mr. Roy C. Andrews, American Museum of Natural History, New York; Mr. Outram Bangs, Museum of Comparative Zoölogy, Cambridge; Mr. Gerrit S. Miller, Jr., National Museum, Washington; Mr. Witmer Stone, Academy of Natural Sciences, Philadelphia; Mr. H. L. Ward, Milwaukee Public Museum; Dr. H. V. Ogden, Milwaukee; Dr. B. H. Bailey, Coe College Museum, Cedar Rapids, Iowa; and Mr. W. E. Snyder, Beaver Dam, Wisconsin.

In the lists of specimens examined those not contained in the Field Museum collection are indicated as follows: (N. M.) U. S. National Museum; (B. S.) U. S. Biological Survey; (A. M.) American Museum of Natural History; (M. C. Z.) Museum of Comparative Zoölogy; (I. S. L.) Illinois State Laboratory of Natural History, Urbana; (M. P. M.) Milwaukee Public Museum; (O. C.) Collection of Dr. H. V. Ogden, Milwaukee; (S. C.) Collection of Mr. W. E. Snyder, Beaver Dam, Wisconsin; (O.) from other sources, special mention of which is usually made in the text. In all other cases the names of individuals or institutions from which the specimens were received are given in full.

Practically all of the original drawings for the halftones and many of the zinc-etchings are the work of Mr. Leon L. Pray; and the maps and nearly all the cuts of teeth, feet, etc., were carefully drawn by Mr. A. B. Wolcott.

In conclusion, it is a pleasure to express my appreciation of the kind assistance of Mr. William J. Gerhard, Assistant Curator of Entomology in this Museum, in reading proof, preparing the index and constantly aiding me in many ways which materially lessened my labor.

November 1, 1911. CHARLES B. CORY.

* Found dead or trapped.

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INTRODUCTION.

A mammal represents the highest development in the animal kingdom and may be broadly defined as a warm-blooded vertebrate animal more or less covered with hair,* which suckles its young.

To describe it more fully, it is an air-breathing, warm-blooded vertebrate, differing from all other animals except birds in having a four-chambered heart and a complete double circulation, but unlike birds the red blood corpuscles are non-nucleate. The heart and lungs are separated from the abdominal cavity by a muscular diaphragm. With rare exceptions the jaws are armed with teeth. The skull articulates with the first vertebra (*atlas*) of the vertebral column at two separate points (*occipital condyles*). Each half of the lower jaw consists of a single bone which articulates directly with the skull. The female is furnished with teats,† and the young are nourished at first by milk secreted in the milk glands (*mammæ*) of the mother, whence the name of the class. The young are born in various stages of development. Some, like those of the Opossum, are rudimentary at birth; while others are developed but hairless, blind and helpless; and still others when born are fully clothed with hair, with eyes open, and are able to stand and move about from the first.

Mammals differ strikingly in appearance, habits and size: some are aquatic, fish-like and practically hairless, such as the Whales, Porpoises, etc.; while others, like the Bats, are provided with wings enabling them to fly about in the air. The majority are terrestrial, but some are semi-aquatic; others arboreal, passing much of their lives in trees, and some live in burrows in the ground. Some are diurnal and others nocturnal, while a considerable number cannot be strictly included in either category. Most of our species are active in winter,‡ but a

* In marine mammals, such as Whales, while hair is absent in the adult or confined to a few bristles about the mouth, it is noticeably present in the young.

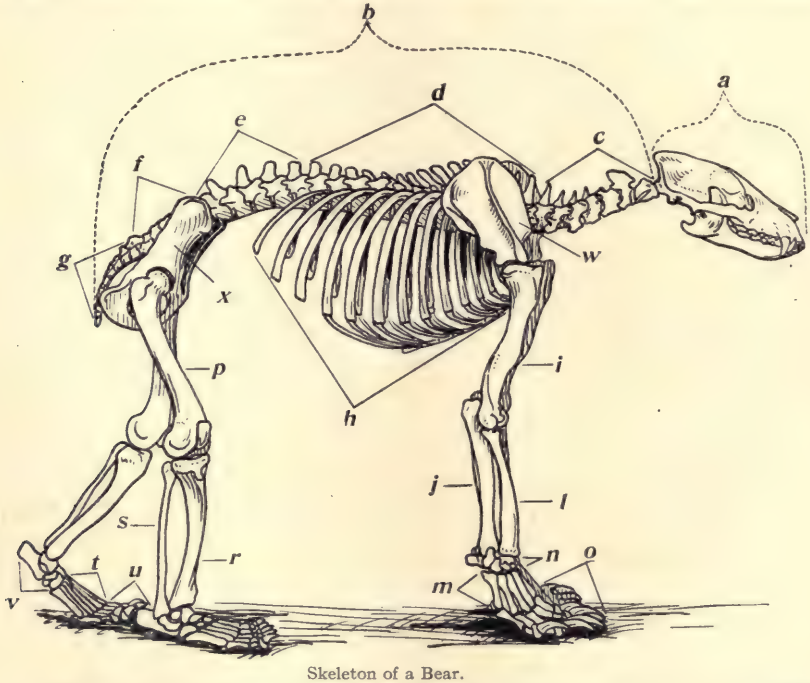
† The Monotremes of the Australian region furnish the only exception; the females have mammary glands but no developed teats.

‡ The seeming scarcity or absence of many species in winter is due to their mode of life, as comparatively few of them migrate in the strict sense of the word. Some of them, having stored up food in their homes during the summer, remain indoors during the cold weather and come out but little; while others hibernate in winter. Among the latter are the Ground Squirrels (*Citellus*), Woodchuck, Chipmunks Jumping Mouse, Badger, Raccoon, Bear and Bats. The phenomenon of hibernation is a strange physiological condition peculiar to certain animals, which enables them to thrive in regions where they would otherwise probably starve in winter, were it not for their ability to remain dormant during such periods of

few hibernate during the cold weather. The majority of mammals are thickly covered with hair, but a few are provided with an armor of hard, scaly plates (Armadillos); and others, with long, sharp quills (Porcupines). In size they vary from the tiny Shrew to the gigantic Sulphur-bottom Whale, having a length of 85 feet or more and a weight of as many tons.

THE OSSEUS SYSTEM.

Having learned what mammals are, it is essential that the student should know something of their anatomy. To enable him to study them intelligently he must know at least the names and locations of the more important bones of the skeleton. For ordinary purposes this can be learned better from a chart than from detailed descriptions,

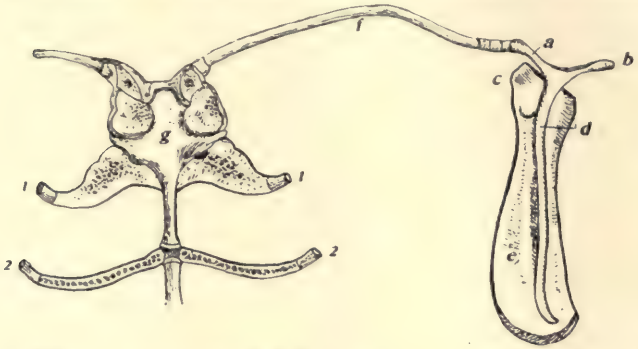


Skeleton of a Bear.

a, Skull; b, vertebral column or back-bone; c, cervical vertebræ; d, dorsal vertebræ; e, lumbar vertebræ; f, sacral vertebræ; g, caudal vertebræ; h, ribs; i, humerus; j, ulna; l, radius; m, metacarpals; n, carpal bones or carpus; o, phalanges; p, femur; r, tibia; s, fibula; t, metatarsals; u, phalanges; v, tarsal bones; w, scapula; x, pelvic girdle or hip bone

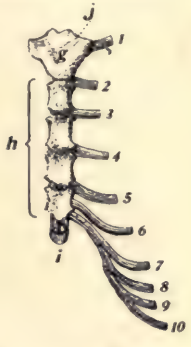
food scarcity. The condition varies in duration and intensity in different mammals. Some hibernate for only short periods during the coldest weather, while others remain for months in a comatose condition. In the latter the bodily temperature and action of the respiratory organs are greatly affected. While undoubtedly due originally to climatic conditions, the habit has become hereditary, as illustrated by certain southern species, which continue to hibernate when the occasion for it no longer exists. Further remarks are unnecessary here, as the subject is discussed more fully ater in connection with the habits of the various species.

which in any event would require far too much space in a work of this nature. I shall, therefore, discuss briefly only those characters which require explanation, and refer the student to the accompanying charts of skeletons and skulls, the study of which should enable him to learn the names of the most important bones and their relative positions.



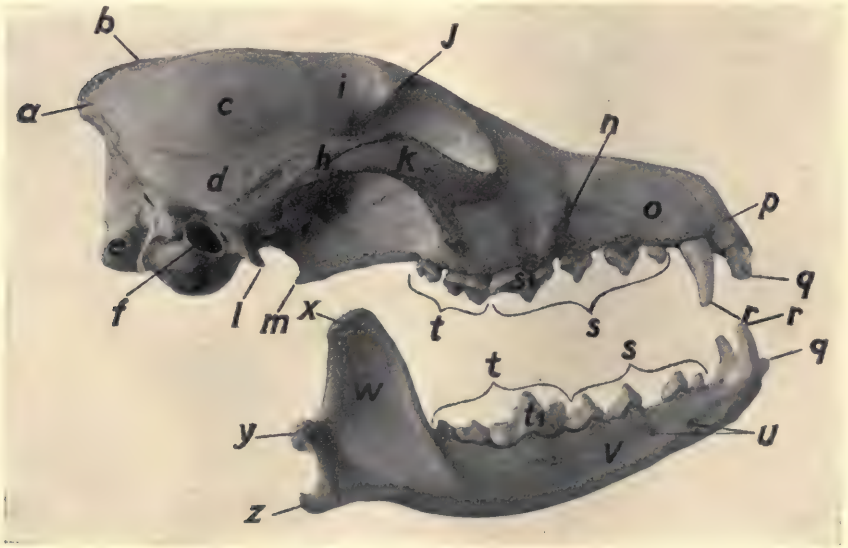
Scapula and clavicle with upper end of sternum and ribs of Shrew (*Sorex*), much enlarged. (Adapted from Flower's Osteology.)

a, Acromion process; b, metacromial process; c, coracoid border; d, "spine" of scapula; e, scapula (includes the entire bone); f, clavicle; g, presternum (upper part of sternum); 1–2 = sections of ribs.



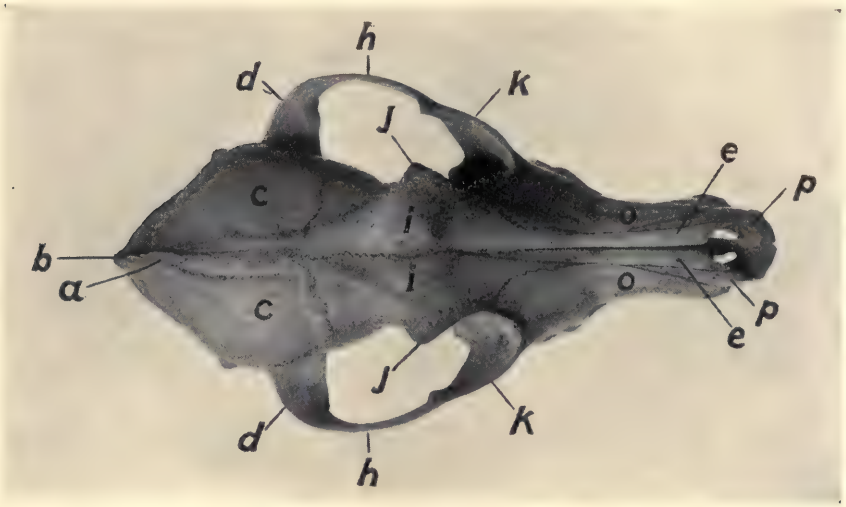
Sternum of Man (much reduced), showing sections of ribs on one side. (After Flower.)

g, Presternum or manubrium sterni; h, mesosternum, body of sternum or gladiolus; i, xiphisternum, xiphoid or ensiform process of sternum; j, point of attachment of clavicle; 1–10 = sections of ribs.



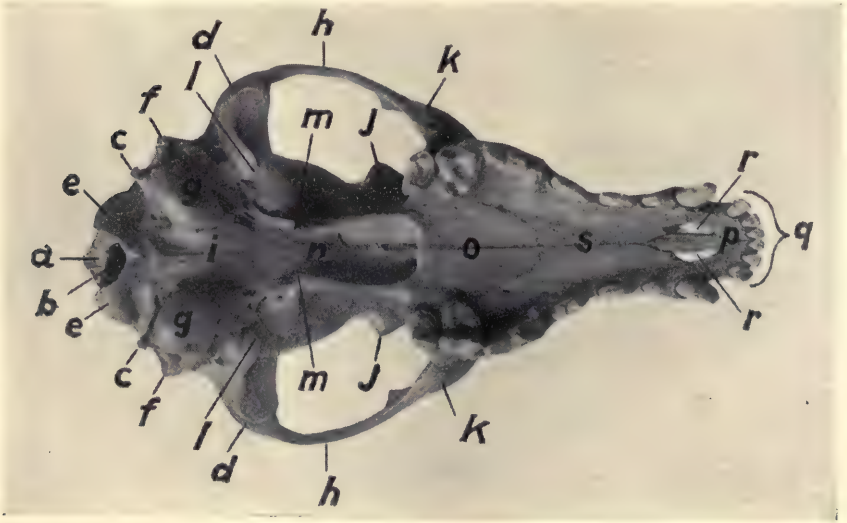
Side view of skull of a Wolf.

a, Interparietal; b, sagittal crest; c, parietal; d, squamosal; e, occipital condyle; f, meatus auditorius externus; g, auditory bulla; h, zygoma or zygomatic arch; i, frontal; j, postorbital process of frontal; k, malar or jugal; l, postglenoid process; m, pterygoid process; n, infraorbital foramen; o, maxilla; p, premaxilla; q, incisors; r, canines; s, premolars; s1, carnassial or sectorial tooth; t, molars; t1, carnassial or sectorial tooth; u, mental foramina; v, horizontal ramus of mandible; w, ascending ramus; x, coronoid process; y, condyle of mandible; z, angular process of mandible.



Upper view of skull of a Wolf.

a, Interparietal; b, sagittal crest; c, parietal; d, zygomatic process of squamosal; e, nasal; h, zygoma or zygomatic arch; i, frontal; j, postorbital process of frontal; k, malar or jugal (the postorbital process of the jugal is shown but not lettered); o, maxilla or maxillary bone; p, premaxilla.



Under view of skull of a Wolf.

a, Supraoccipital; b, foramen magnum; c, paraoccipital process; d, zygomatic process of squamosal; e, occipital condyle; f, mastoid process; g, auditory bulla; h, zygoma or zygomatic arch; i, basi-occipital; j, postorbital process of the frontal (the corresponding process of the jugal or malar bone opposite to it is known as the postorbital process of the malar); k, malar or jugal; l, postglenoid process; m, pterygoid process; n, presphenoid; o, palatine; p, premaxilla; q, incisors; r, anterior palatine foramina; s, under portions of maxillary bones.

The Skull — The skull is composed of a number of bones which, with the exception of the lower jaw, are immovably joined together. In early life they are largely connected by intervening tissue, which in most cases becomes ossified later. The "cracks" seen in a skull where the bones join are called *sutures.** Holes and openings are called *foramina;* and elongated points (processes), ridges, cavities, etc., are all recognized by names (see illustrations, pages 11-12).

The Teeth — Teeth are hard formations which are present in the jaws of most mammals. They are enderonic structures, which develop from odontoblasts and are chiefly composed of calcium phosphate.† The greater portion of a tooth is made up of what is called *dentine,* having a cavity in the center containing what is known as "pulp," a soft mass of connective tissue supplied with blood vessels and nerves. The exposed outer surface of the tooth is covered with a thin but extremely hard layer known as the *enamel.* From a systematic standpoint the teeth are of great importance, inasmuch as their various well defined characters furnish differences upon which many of the genera and species, as well as some of the higher orders, are based. The majority of mammals have two sets of teeth‡ known respectively as "milk teeth" and permanent teeth. The former are the temporary teeth of the young and are later replaced by permanent teeth. In mammals which have both milk and permanent teeth, the number of the former varies greatly in different species, ranging from a single tooth on the side of each jaw (as in the Marsupials and some Rodents) to the greater portion of the series. In some cases milk teeth are present but are not functional, and do not appear above the gum. Mammals in which the first teeth are permanent are called *Monophyodont,* while those which have in early life desiduous teeth, which are later replaced by permanent teeth, are called *Diphyodont.*

Teeth are divided into four groups which may be described as follows:

Incisors: Teeth with cutting edges and simple roots, which are implanted in the premaxillary bone in the center or front of the jaw.

Canines: Usually four in number, two in the upper jaw and two in the lower.§ They are situated (when present) in the maxil-

* For further remarks on sutures, see page 37.

† The Monotremes furnish an exception, the teeth of the Duck-bill being of horny construction.

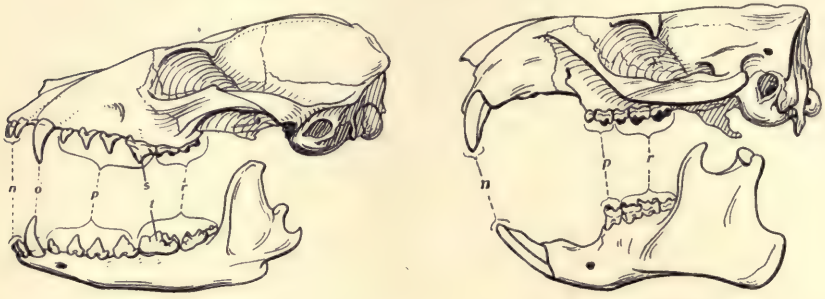
‡ The Monotremes, Toothed Whales and most of the Edentates have but one.

§ The Shrews apparently have two canine teeth in the upper jaw, but none in the lower.

lary bone just behind the premaxillary suture, or what might be described as at the angle of the front of the jaw, one on each side.

Premolars: Teeth on side of jaw (maxillary bone), between the canines and the molars. These teeth replace the milk teeth at an early age.

Molars: The "back teeth," situated immediately behind the premolars on side of jaw. These are permanent teeth which are not represented early in life by milk teeth.



Skull of a Carnivore. (Canines present.)

Skull of a Rodent. (Canines absent.)

n, Incisor teeth or incisors; o, canine teeth; p, premolar teeth; r, molar teeth; s, upper carnassial tooth; t, lower carnassial tooth.

Certain forms of teeth are given special names. In carnivorous mammals, for example, the anterior molar in the lower jaw and the posterior premolar in the upper are larger and more prominent than the others and are known as the *carnassial* (or sectorial) teeth. Those with flattened crowns, from which points or tubercles arise, are called tuberculate teeth, etc. In the Insectivora many of the teeth are of a generalized type, being small, single pointed and showing little or no difference in shape and are known collectively as *unicuspid* teeth. Further remarks on this subject are unnecessary here, as the more important dental characters are treated under the different families and genera.

For convenience in describing the dentition the following formula has been adopted by zoölogists:—

I. = incisors, C. = canines, Pm. = premolars, M. = molars.

The dental formula of the Virginia Opossum would, therefore, read as follows:

$$\text{I. } \frac{5-5}{4-4},\ \text{C. } \frac{1-1}{1-1},\ \text{Pm. } \frac{3-3}{3-3},\ \text{M. } \frac{4-4}{4-4}, = 50,$$

the numbers above the line indicating the number of teeth on the upper jaw, and those below the line, on the lower.

Some zoölogists still further abbreviate the formula, giving only one side of the jaw, as the number of teeth on both sides are supposed to be alike, thus:

$$\text{I. } \frac{5}{4},\ \text{C. } \frac{1}{1},\ \text{Pm. } \frac{3}{3},\ \text{M. } \frac{4}{4} \times 2 = 50.$$

A reference to a single tooth is often written as follows: (Pm. 1) and would mean the first *upper* premolar, or (Pm. 2), which would refer to the second *lower* premolar.

The variation in the number of teeth in different mammals is very great. The Anteaters (*Myrmecophagidæ*) have no teeth; the Narwhal, for example, may be said to have but one, although there is another in a rudimentary state imbedded in the upper jaw. Some Rodents have 12, others 20; Sloths have 18; Rabbits 28; Man 32; the Armadillo 98; and the Dolphin more than 100. There is also an extraordinary difference in size and shape as, for example, the tusks of the Elephant and the enormously developed tusk or "horn" of the male Narwhal.

The Vertebral Column, Spinal Column or "Back-bone," consists of a number of bones connected by cartilages. It is generally considered as divided into five regions known as the *cervical* (neck); *dorsal* (back), which supports the ribs; *lumbar* (small of the back); *sacral* (between the *lumbar* and *caudal*), consisting of several vertebræ fused together and supported by the pelvic girdles; and the *caudal* or bones of the tail (see illustration, p. 10.). The number of vertebræ varies greatly in different mammals. For example, while in Man the caudal vertebræ consist of but three more or less rudimentary bones, the tail of the African Scaly Anteater (*Manis*) has 46.

The Pelvis is the bony framework formed by the pelvic girdles or hip bones and including the sacral vertebræ.

The Ribs — The number of ribs varies in different mammals. They are curved bones which are movably articulated with the dorsal vertebræ, and the upper ones are attached to the sternum with a cartilage which becomes ossified in but few forms. The lower ribs, which are not directly attached to the sternum, are called "floating ribs."

The Sternum or Breast-bone is a bone, or series of bones (*sternebræ*), connected on each side by cartilage with the ribs. In most cases these connections remain cartilaginous during life, ossification occurring in but few cases. The sections of the sternum vary in character and number. The upper part is called the *presternum*, or *manubrium sterni* of human anatomy; the sections below this (except

the terminal part) are collectively known as *mesosternum*, while the lower end is called *xiphisternum*, xiphoid, or ensiform process of the sternum (see chart, p. 11). The presternum is often "keeled," having a ridge along the middle line below, noticeably in the Bats, which like the birds require support for a large pectoral muscle as an aid to flight.

Scapula, generally a broad, flat bone commonly called the "shoulder blade," which is present in all mammals. It has a median ridge on the outer surface which is called the "spine," the projecting end of which is known as the *acromion process*.

Clavicle or collar bone in Man articulates with the upper border of the sternum and the acromion process of the scapula. It is present and complete in some mammals, such as Primates (Man, Monkeys, Apes, etc.), Bats, Insectivores, and others; and appears in rudimentary form in others, such as most of the Carnivores, some Rodents, etc., but it is absent in Whales, Seals, Ungulates, some of the Bears, some Rodents, and others.

The Limbs and Feet — All mammals, with the exception of some of the aquatic species such as Whales, Manatees, etc., have four limbs and for this reason are often called Quadrupeds. In the fore limbs the bone of the upper arm is called the *humerus*; the lower part of the arm or "fore arm" has two bones, the *radius* and *ulna*. The wrist or carpal joint consists of several bones, usually 5 to 8, known as the bones of the *carpus*. The bones of the hand are designated as *metacarpals* and those of the fingers, *phalanges*.

As has already been stated, the hind limbs are lacking in aquatic species, such as the Whales and Manatees. In the former even the pelvis is rudimentary and is represented by two small detached bones not connected with the skeleton. The bones of the hind limbs are: Thigh, *femur;* lower leg bones, *tibia* and *fibula;* ankle joint, bones of the *tarsus;* bones of the foot, *metatarsals;* and toes, *phalanges*.

The variation in the character and shape of the limbs and feet is very great, as illustrated by the "flippers" of a Seal, the feet of a Horse or those of a Lion, Deer, Sloth, Monkey, Mole, etc. In some species practically the whole sole of the foot touches the ground in walking; these are known as *plantigrade*. Others walk on their toes and are called *digitigrade*.* In the Horse, for example, the true heel is elevated a foot or more from the ground.

In nearly all mammals † the terminal extremities of the digits are protected by hard epidermal structures in the form of claws, nails, and

*Intermediate types are often termed *semi-plantigrade, unguligrade*, etc.

† Absent in the Whales, but rudiments have been found in the fœtus.

Hind foot of Wolf.

Fore foot of Horse.

Hind foot of Deer.

Hind foot of Rabbit.

Hind foot of Opossum.

Fore foot of Mole

Bear.
Plantigrade type of foot.
(Practically whole sole of foot touching the ground.)

Panther.

Horse.

Deer.

Digitigrade type of foot.
(Only toes touching the ground.)

hoofs, which have been developed by modification and thickening of the cuticle. The number of digits normally vary from 1 to 5 in different animals. In the Deer the first is absent, the 3d and 4th support functional hoofs, and the 2d and 5th appear as small, elevated lateral hoofs or "false hoofs." In the Horse the foot structure consists of a single digit (the 3d), the others having been lost.*

ANATOMICAL AND PHYSIOLOGICAL CHARACTERS IN GENERAL.

Having gained some slight knowledge of the bony framework, it is essential that the student should know something more about their

*Palæontologists have been able to trace the evolution of the foot of the Horse from its four-toed Eocene ancestor, showing the gradual lessening in the number of digits. Prof. Cope believed the five-toed *Coryphodon* to represent a group, from which all Ungulates have sprung.

external and internal structure before proceeding to take up the study of the living mammals. It is obvious that adequate treatment of such a great subject as mammalian anatomy would be impossible in any such condensed form as would be necessary, if attempted here. I shall, therefore, confine myself to brief remarks (which are intended for the use of beginners only) concerning those parts which will be referred to later in connection with the descriptions of the families and genera included in this work.

TEGUMENTARY STRUCTURES.

Hoofs, Claws and Nails — These are hard, horny modifications of the epidermis,* and with few exceptions (*Cete*) are present on the terminal extremities of the digits. They vary greatly in character, but it is unnecessary to discuss them here, as the differences in the various species which occur within our limits are described later.

Hair — A hair may be considered as an outgrowth of the epidermis, elongated and generally cylindrical in shape, and extends from a papilla at the bottom of a follicle in the true skin,* but in some cases it is flattened and not round, as illustrated in the curly haired races of Men, a few of the Rodents and some others. With few exceptions the outer surface is hard and the inner portion cellular, surrounded by a cortex, the latter containing the color pigment, and is covered by a cuticle which may be smooth or rough and squamate. In some species of Bats (*Molossidæ*) for example, the hair when viewed under a powerful microscope shows rings or zones of verticulate spinules; while in our species, belonging to the family *Vespertilionidæ*, the spinules are arranged in a continuous spiral, or in imbricated triangles and often in various other patterns (see illustration, p. 446). Hairs vary enormously in size and degree of rigidity in different mammals; as take for examples the soft fur of the Mole, the bristles of the Pig, and the spines or quills of the Porcupine, all of which are merely modified forms of the same structural growth; and it is probable that a still further modification has developed the horns of the Rhinoceros. In color the various shades of brown predominate. Bright colors are the exception and when present are mostly confined to orange and red, as illustrated in some South American Squirrels and other exotic forms. Usually animals of the same species are uniformly colored, but occasionally an excess of pigmentation results in a black (*melanistic*) individual, or an absence of color pigment produces a white (*albinistic*) one, which should normally be of some other color. Comparatively few mammals are

*For definition see Glossary, p. 489.

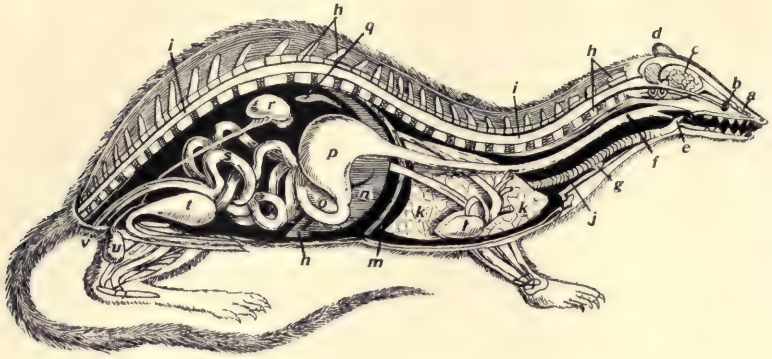
naturally white, and these are largely restricted to boreal species, although there are a number of exceptions including a white Bat which occurs in South America. While in some cases, such as the tail of a Horse, the hairs appear to be permanent, as a rule they are periodically shed and replaced by a new growth. In the majority of mammals the color of the new hair differs but little and the change in appearance of the animal is comparatively slight; but in some species, like our Weasels and Varying Hare, there is a complete semiannual change of color in some localities. In some mammals the long bristley hairs or *vibrissæ* (commonly called whiskers), which extend from the side of the face, are connected with exceedingly sensitive nerves and perform a sensory function. These, however, will be referred to again under the organs of sense.

Odor-secreting Glands — In many mammals there are present integumental glands located in various parts of the body, the secretions of which serve to attract others of their kind, and in a number of cases their functions seem to be two-fold, as they furnish a means of defense against their enemies as well. The Skunk may be cited as one of the best known examples of the latter class, on account of its well-known ability to eject by muscular contraction, a noxious smelling liquid for a considerable distance. In a large number of mammals possessing glands of this character the secretions are characterized by their musky odor and are variable in intensity, many of them being comparatively inoffensive. In some cases these glands are developed in the male only, but in others they are present in both sexes.

As illustrating the diversity of location of this group of structures in various species, we may mention the anal glands of various Carnivores, such as the Skunks, Wolverines, etc., the preputial glands of the Musk Deer and Beaver, dorsal glands of the Peccary, foot gland of the Rhinoceros, and those between the toes of many of the Ruminants, the suborbital glands of the Antelope, temporal gland of the Elephant, caudal gland of the Dog, Fox, etc., and the variously situated glands of Bats, Shrews, Mice, and many others.

CIRCULATORY AND DIGESTIVE SYSTEMS.

The body cavity of a mammal is divided into two sections separated by a muscular diaphragm. The upper or plural cavity contains the heart and lungs, while the lower or peritoneal cavity contains the stomach, intestines, liver, etc. Of these organs I shall briefly discuss those which will be referred to later in connection with the various families included in this work.

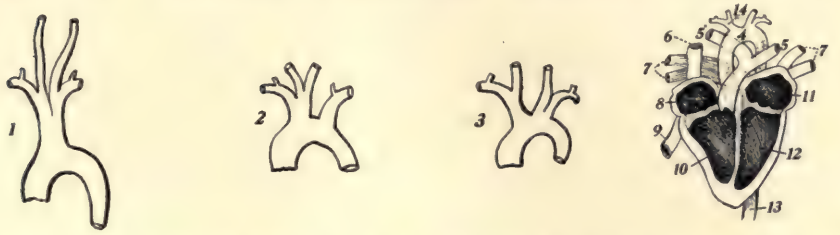


Ideal section of a Mammal.

a, Olfactory nerves; b, optic nerve; c, brain; d, ear conch or pinna; e, epiglottis; f, œsophagus; g, thyroid glands; h, vertebral column or back-bone; i, spinal cord; j, trachea; k, lungs; l, heart; m, diaphram; n, liver; o, pancreas; p, stomach; q, spleen; r, kidney; s, intestines; t, bladder; u, scrotum and testes; v, anus. (After Owen.)

The Heart — The heart in all mammals is divided into four chambers known as auricles and ventricles, but the shape is more or less variable in different forms. Each auricle communicates with the ventricle of the same side, the opening being provided with valves which permit the blood to pass only in the right direction, viz., from the auricle to the ventricle. Briefly stated, the circulation of the blood is accomplished as follows: It enters the right auricle, which is supplied by means of the venæ cavæ, and thence to the ventricle of the same side, from whence it is forced into the lungs through the pulmonary artery and there absorbs the necessary oxygen and is relieved of carbon dioxide. From the lungs by means of the pulmonary veins it enters the left auricle and passes through the left ventricle into the aorta, passing out again through the large arteries (such as the "carotid" and "brachial"), which arise from it, and thence into the general system, where, after passing through the capillaries, it is conducted by a diversity of veins to the large superior and inferior venæ cavæ and thence back again to the right auricle.

There is considerable variation in mammals in the mode in which different arteries arise from the aorta. In most cases the right brachial and right carotid have a common origin known as the innominate artery in human anatomy. The other two may extend from this, as in the Ungulates, or may arise separately from the aorta, as in Man, or as is common in many species, the left carotid may arise from the "innominate" and the left brachial



Origin of arteries from the aortic arch, illustrating three of the various types: 1, Ox; 2, Lion; 3, Man. (After Owen.) Heart of man: 4, aorta; 5, pulmonary artery; 6, superior vena cava; 7, pulmonary veins; 8, right auricle; 9, inferior vena cava; 10 right ventricle; 11, left auricle; 12 left ventricle; 13 aorta; 14, innominate artery. (After Tenney.)

directly from the aorta, or again there may be a right and left "innominate," from which arise the respective carotid and brachial arteries, as in some of the Bats and Insectivores. The circulatory system is much further diversified in many other mammals, but enough has been said regarding the subject.

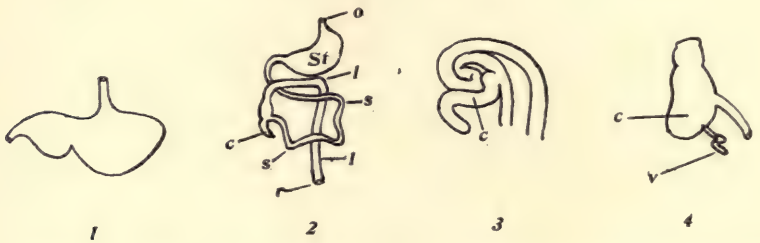
The Lungs — The lungs of a mammal differ from those of the lower vertebrates by being separated from the abdominal cavity by a diaphragm. They are spongy masses made up of numerous air passages and cells surrounded by a capillary network in which the blood, in passing through the lungs, absorbs oxygen, at the same time giving off carbon dioxide. In terrestrial forms they are more or less extensively lobated in form and are often not symmetrical, the number of lobes differing in the two lungs of the same animal.

Blood — The blood of mammals is red and warm, varying in temperature in different species under normal conditions from a few degrees below to a few degrees above 100° Fahr. The corpuscles are of two kinds: the colored non-nucleated flattened disks, having a circular outline*; and the less numerous "white corpuscles," which are colorless and nucleated. The size of the red non-nucleating blood corpuscles varies in different mammals, and this fact is often of importance in criminal trials as an aid in identifying human blood; but in such cases, while it is very often possible to determine that the blood in question is not human, by this test alone, it is not always possible to be absolutely certain that it is. For example, the diameters of the circular blood corpuscles in species of Deer range from $\frac{1}{5000}$ to $\frac{1}{12000}$ of an inch; those of domestic Sheep are $\frac{1}{5300}$; of the Horse $\frac{1}{4600}$; while in Man they usually measure from about $\frac{1}{3000}$ to $\frac{1}{3200}$, but occasionally they are smaller, cases having been recorded

* Exceptions to this are found in the Camels, Llamas, and a few others, in which they are elliptical in outline, as in most of the lower vertebrates.

where in Man they measured only $\frac{1}{3600}$ and even less. Under such conditions an expert depending upon size alone * could not readily distinguish them from those of a Dog, or an Ape. The following measurements of red corpuscles of various mammals are selected from those given by Prof. G. Gulliver (Proc. Zoöl. Soc. Lond., 1845, p. 96; *Ib.*, 1862, p. 102): Elephant $\frac{1}{2745}$, Man $\frac{1}{3200}$, Ape $\frac{1}{3412}$, Beaver $\frac{1}{3325}$, Wolf $\frac{1}{3600}$, Tiger $\frac{1}{4206}$, Bat $\frac{1}{4324}$, Horse $\frac{1}{4600}$, Sheep $\frac{1}{5300}$, Red Deer $\frac{1}{5000}$, Musk Deer $\frac{1}{12000}$.

Stomach and Intestinal Canal — The passage through which food passes from the mouth to the stomach is called the *œsophagus*, and in the majority of mammals the stomach consists of a single chamber, although varying somewhat in shape in different species. Sometimes it is divided into a series of chambers, as in the Ruminants, in which group the stomach contains at least three and usually four sections; or in the Cete, where the number varies from 3 to 8.



1 2 3 4

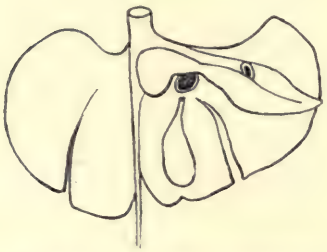
1, Stomach of Mouse. (After Wiedersheim.) 2, Common type of alimentary canal in many mammals. l, large intestine; s, small intestine (much abbreviated); c, cœcum; r, rectum; o, œsophagus. (After Flower and Lydekker.) 3, Portion of intestine, showing cœcum, of Proboscidion Shrew. c, cœcum. (After Owen.) 4, Common type of cœcum in Man. c, cœcum; v, vermiform appendix. (After Gray.)

At the lower end of the stomach is what is called the *pylorus*, where it joins the small intestine, which in turn continues to the large intestine or colon which ultimately ends at the rectum. At the juncture of the large and small intestines there is usually a blind sac or pouch, known as the *caput cæcum coli*, but which has popularly been abbreviated into "*cæcum*" (see illustration). This organ varies greatly in different mammals. In some species it is merely a slight bulge or apparently absent, while in others it is largely developed. Ruminant animals have large cæcæ, but in the Cat tribe it is but slightly indicated. The Phalanger, *Trichosurus vulpecula*, has a cæcum fully one-fifth as long as the small intestine. In Man the cæcum is present in the form of a sac two or three

* The serological test (based upon the chemical character of the blood serum) is of value in most diagnoses, but cannot be depended upon to distinguish the blood of Man from that of some of the higher Apes.

inches in length and slightly more in breadth, and extending from it is what is known as the *vermiform appendix*, a narrow worm-like tube which is, so far as known, found only in Man, the higher Apes and the Wombat.

The Liver — This organ is situated on the right side of the abdominal cavity, and is usually divided into a right and left half, being again subdivided by deep clefts into lobes in different mammals. As a rule, these divisions are more numerous in carnivorous animals than in vegetable feeders. The gall bladder is present in some species and absent in others.



Plan of inferior surface of multilobed liver of a mammal. (From Flower and Lydekker.)

Urinary Organs — The kidneys in most mammals are compact, oval-shaped organs, having a depression at the border where the ducts enter; but in a few cases they are lobate, as in the Whales, Seals, Bears, some of the Ungulates, and a few others. They are situated in the back part of the abdominal cavity behind the peritoneum and opposite the upper lumbar vertebræ, and as a rule one of them lies in a more advanced position than the other. The ureters connect the kidneys with the urinary bladder and open directly into it in the higher Mammalia, but lower down into the urino-genital passage in the lower members of the class.

Reproductive Organs — Lengthy discussion of this group of organs is unnecessary here, and will be confined to a few general statements concerning them.

In all mammals a penis is present and almost always completely developed in the male. In the Feræ, Glires, Insectivora, Chiroptera, and all except a few of the higher Primates, an os penis is present, but is lacking in the other orders. The testes of the male in the majority of cases pass out of the abdominal cavity either periodically (as in Insectivora, Chiroptera and Glires), or permanently, as in most other mammals, and in the latter case, are suspended in a pouch or scrotum. In the Marsupials the testes are suspended in front of the penis.

In the Whales, Seals, Elephants, Monotremes, most of the Edentates, and several others, they retain their internal position throughout life.

In all mammals, except the Monotremes and most of the Marsupials, a placenta is formed by a union of the allantois with the

membranes of the uterus, and through this placenta the embryo is nourished.

In all female mammals, except the Monotremes, the intestinal and genital openings are separate, but in the latter they open into the cloaca, as in birds.

Mammary Glands — These glands secrete milk by which the young are nourished and are present in both sexes in all mammals, but are usually only functional in the female.

In all except the Monotremes their orifices are situated upon the end of conical elevations called *mammilæ*, or *teats*, which are taken into the mouth of the young animal. In the Whales the glands are unusually developed and a quantity of milk is injected into the mouth of the young by muscular contraction. In the Monotremes the teats are lacking, the ducts of the mammary glands opening through pore-like orifices in the skin. In addition to a number of other peculiar characters, these strange mammals are claimed to be oviparous, the eggs resembling in development those of a reptile.

NERVOUS SYSTEM AND ORGANS OF SENSE.

The Brain — The brain is contained in the cavity of the skull. The greater portion is called the *cerebrum;* a much smaller portion at the back of the skull cavity is known as the *cerebellum;* and the commencement of the spinal marrow, as the *medulla oblongata*. The brain of a mammal differs from that of other vertebrates in having the two hemispheres of the cerebellum united by a commissure (*pons varolii*) and the cerebral hemispheres more or less connected by an anterior and a superior transverse commissure, the *corpus collosum* of anatomical text books. In most mammals the brain is more or less convoluted, highly so in Man, varying in degree in many, or not at all as in some of the Marmosets (*Hapale*).

Spinal Cord — The main nerve axis of the body passing through the vertebræ from head to tail, but which it is unnecessary to discuss here.

The Sense of Touch — An increased supply of nerves and blood-vessels to a part of the skin renders it more sensitive and susceptible to what is called the sense of touch. Dermal susceptibility for this reason differs in various parts of the body. For example, in Man the ends of the fingers, from being supplied abundantly with pencillate plexuses of nerves, are much more sensitive than portions of the arm or back. The lips and tongue are still more so, the latter usually being capable of distinguishing distinct sensations when touched by the points of a pair of dividers when separated only $\frac{1}{25}$

of an inch. On the shoulder, however, unless the points are more than ¼ of an inch apart, they can not be distinguished; and portions of the back are so insensitive as to require the points to be separated as much as 2 inches to give the impression of more than a single point of contact. Many mammals are provided with long hairs or bristles in more or less specialized regions, such as eyebrows, cheeks and lips, which are connected by their basal papillæ with sensory nerve filaments and on which the sense of touch is very highly developed. The whiskers (*vibrissæ*) of the common House Cat belong to this category. In Bats the wing membrane is well supplied with nerves and is so sensitive as to enable the animals to avoid objects in their flight.

The Sense of Sight — While eyes are present in all mammals, in some, like the Moles, they are small and practically rudimentary, in a few cases being covered by the skin; but the sense of sight is highly developed in the majority of the class. There is considerable variation in the color and shape of the eye in different species, and the pupil varies from circular to elliptical. In many mammals there is a modification of the choroid known as the *tapetum lucidum*, which is a membrane exhibiting green and blue reflections, and which is the cause of the striking appearance of the eyes of many animals in the dark. In some of the smaller Cats the pupil contracts to a vertical slit, while in the larger felines it remains circular. In most of the mammals the eye is protected by an upper and a lower lid which close over the front, meeting in a nearly horizontal slit. In the Sirenia, however, the lids are not distinct and the aperture is circular, drawing together at a central point. In the eyes of all mammals excepting those of the Primates and the Cete, a third eyelid is present called a nictitating membrane, which is placed at the inner corner of the eye and passes horizontally over the eyeball under the true eyelids. This is apparently for the purpose of cleaning the cornea and is represented in a rudimentary form in Man and other Primates in the shape of the so-called *semilunar fold* at the inner angle of the eye. In all mammals excepting some of the aquatic species, the eye is kept moist by the secretions of the lachrymal gland situated in the upper lid at the outer side. In Man, in whom the gland is highly developed, this secretion is most susceptible of being secreted to excess and a consequent overflow in the shape of tears. The eyelids are lubricated by other glands. In some mammals, like the Hares and Jerboas, the eyes are large and prominent, and from their lateral position it is claimed they are susceptible of perceiving the image of a pursuer.

The Sense of Smell — The sense of smell is present in all mammals, with the possible exception of the Toothed Whales. Branches of the olfactory nerves are present in the upper portion of the nasal passage, which come in contact with any odorous particles contained in the air and which enter the nose. In many species this sense is developed to a most extraordinary degree, warning them of the approach of other animals at a surprisingly long distance. Trappers have learned by experience that, if a trap is touched with the bare hand, many species will not approach it for at least 24 hours.

The Sense of Hearing — The organ of hearing is present in all mammals, but, as would be expected, is developed in some much more highly than in others. It is divisible into three parts: 1, external ear or pinna and the auditory canal or meatus; 2, the middle ear or tympanum; 3, the internal ear or labyrinth. The pinna is present in most mammals and is generally movably articulated to the skull, and by muscular attachment enables the animal to turn it in the proper direction to aid in collecting and directing the vibration of sound into the meatus. While these ear muscles are present in the ear of Man, from long disuse they are no longer functional except in rare cases. The middle ear, drum of the ear, or tympanum, as it is variously called, which forms the outer wall of the cavity, is traversed by a chain of three or four movable small bones, three of which are always present and are known, respectively, as *malleus*, *incus*, and *stapes*. These bones are variable in size and character in different mammals, especially in aquatic species. The malleus in mammalian anatomy represents the quadrate bone of the lower orders, which there connects the lower jaw with the skull. The internal ear, or labyrinth as it is called, consists of three semi-circular canals, a vestibule and a cochlea. Here again is found, with the exception of the Monotremes, a distinct mammalian character in the spiral convolutions of the cochlea. By the vibrations of the tympanic mem brane (produced by sound waves) and the small bones, the vibrations of sound are transmitted from the exterior to the fluid filling the internal ear and are appreciated by the end filaments of the auditory nerve, thus enabling the animal to hear.

The Sense of Taste — The sense of taste concerns us little here and will be dismissed with the brief statement that it is chiefly located in the papillæ on the dorsal surface of the tongue, although similar papillæ are present in other parts of the mouth, such as the soft palate, epiglottis, etc. These papillæ are each furnished with a branch of the glossopharyngeal nerve.

TAXONOMY AND CLASSIFICATION.

Taxonomy as applied to zoölogy is the science of arranging animals in what is deduced from study of their morphological characters to be their natural order or sequence and from which a system of classification has been evolved. The necessity of some such an arrangement is sufficiently obvious as to hardly require explanation, but I will quote the words of Prof. Huxley in this connection, who says:*

"It is possible and conceivable that every animal should have been constructed upon a plan of its own, having no resemblance whatever to the plan of any other animal. For any reason we can discover to the contrary, that combination of natural forces which we term Life might have resulted from, or been manifested by, a series of infinitely diverse structures, nor would anything in the nature of the case lead us to suspect a community of organization between animals so different in habit and in appearance as a porpoise and a gazelle, an eagle and a crocodile, or a butterfly and a lobster. Had animals been thus independently organized, each working out its life by a mechanism peculiar to itself, such a classification as that now under contemplation would be obviously impossible; a morphological or structural classification plainly implying morphological or structural resemblances in the things classified. As a matter of fact, however, no such mutual independence of animal forms exists in nature. On the contrary, the members of the animal kingdom, from the highest to the lowest, are marvellously connected. Every animal has something in common with all its fellows; much, with many of them; more, with a few, and usually so much with several, that it differs but little from them.

"Now a morphological classification is a statement of these gradations of likeness which are observable in animal structures, and its objects and uses are manifold. In the first place it strives to throw our knowledge of the facts which underlie, and are the cause of, the similarities discerned, into the fewest possible general propositions, subordinate to one another, according to their greater or less degree of generality; and in this way it answers the purpose of a *memoria technica*, without which the mind would be incompetent to grasp and retain the multifarious details of anatomical science. But there is a second and even more important aspect of morphological classification. Every group in that classification is such in virtue of certain structural characters, which are not only common to the members of the group, but distinguish it from all others; and the statements of these constitute the definition of the group."

*Huxley, T. H. Introd. Classif. of Animals, London, 1869, pp. 2–3.

In spite of the continually advancing knowledge, due largely to constant discoveries of new forms both living and extinct, there are a great many links missing in the zoölogical chain, and it is not surprising that systematists are not entirely in accord in their conclusions and that any system of classification at present evolved, must of necessity be more or less tentative.

Nearly all modern zoölogists now recognize two subclasses of living mammals: I, Prototheria, comprising a single Order, Monotremata, to which belong the Spiny Anteaters (*Echidnidæ*) and Duck-bill (*Ornithorhynchidæ*) of the Australian region — strange egg-laying animals which differ anatomically in many ways from other known forms; and II, Eutheria, which includes the rest of the Orders. The Metatheria, containing the Order Marsupialia, or pouched mammals, such as the Kangaroos, Opossums, etc., was at one time given rank as a third subclass but is now generally included with Eutheria.* The subclasses and orders comprising the living mammals of the world are as follows:

KINGDOM ANIMALIA. ANIMALS.

SUBKINGDOM VERTEBRATA. BACK-BONED ANIMALS.

CLASS MAMMALIA. MAMMALS.

SUBCLASS PROTOTHERIA.
Order MONOTREMATA. Duck-bill Platypus, Echidnas.

SUBCLASS EUTHERIA.
Order MARSUPIALIA. Marsupials or Pouched Mammals.
Suborder Polyprotodontia. Opossums, Bandicoots, etc.
Suborder Diprotodontia. Kangaroos, Wombats, etc.

Order EDENTATA. Sloths, Armadillos, etc.
Suborder Zenarthra. Armadillos, Sloths, Anteaters, etc.
Suborder Nomarthra. Aard-varks and Scaly Anteaters.

Order UNGULATA. Hoofed Mammals.
Suborder Proboscidea. Elephants.
Suborder Hyracoidea. Hyraxes.
Suborder Perissodactyla. Horses, Tapirs, Rhinoceros, etc.
Suborder Artiodactyla. Pigs, Cattle, Sheep, Antelopes, Deer, Giraffes, Camels, Hippopotami, etc.

Order SIRENIA. Manatees, Dugongs.

Order CETE. Whales, etc.
Suborder Mysticete. Whalebone Whales.
Suborder Odontocete. Toothed Whales (Sperm Whales, Porpoises, Dolphins, Narwhal, etc.).

*The absence of an allantoic placenta in all Marsupials has been disproved by its discovery in *Parameles*.

Order GLIRES. Gnawing Mammals.
Suborder Simplicidentata. Rats, Porcupines, Squirrels, Beavers, etc.
Suborder Duplicidentata. Rabbits, Hares, Picas, etc.

Order FERÆ. Flesh Eaters.
Suborder Fissipedia. Cats, Hyenas, Dogs, Bears, Raccoons, Skunks, Otters, etc.
Suborder Pinnipedia. Seals and Walruses.

Order INSECTIVORA. Insect Eaters.
Suborder Insectivora Vera. Moles, Shrews, Hedgehogs, etc.
Suborder Dermoptera. Flying Lemurs.

Order CHIROPTERA. Bats.
Suborder Megachiroptera. Frugivorous Bats.
Suborder Microchiroptera. Insectivorous Bats, etc.

Order PRIMATES.
Suborder Lemuroidea. Lemurs, etc.
Suborder Anthropoidea. Monkeys, Apes, Man.

Having separated the mammals into subclasses, orders and suborders, the systematist still further divides them into families, subfamilies, genera, subgenera, and finally into species and subspecies.

While the various families are, as a rule, well marked and may be recognized without difficulty, the student will find that this is not always the case where species and subspecies are concerned, especially among the smaller Mammalia. The positive identification of many species often depends almost entirely upon cranial and dental differences, and in the case of subspecies the difficulty is increased, because here the cranial characters help us little. The coloration of many mammals is easily affected by climate and environment. The change in the color of the pelage at different seasons of the year is often more or less confusing to the student, as closely allied forms occupying different areas, which may be perfectly distinguishable at certain seasons, may not be so at others; furthermore, specimens from intermediate localities may be expected to show inter-gradations, which makes the problem still more complex. In this connection it should be borne in mind that the line of demarcation between a species and a subspecies is a purely arbitrary one and is largely a matter of individual opinion. In zoölogical nomenclature subspecies are distinguished by a third name; for example, *Lepus floridanus mearnsii* is a race or subspecies of *Lepus floridanus*.

CLASSIFIED LIST OF THE MAMMALS OF ILLINOIS AND WISCONSIN.

Names in brackets indicate that the species has not been taken within our limits; but occurs in nearby localities within a few miles of our state lines.

ORDER MARSUPIALIA.

SUBORDER POLYPROTODONTIA.

FAMILY DIDELPHIIDÆ. OPOSSUMS, ETC.

GENUS **DIDELPHIS** LINN.

Didelphis virginiana KERR. Virginia Opossum.

ORDER UNGULATA.

SUBORDER ARTIODACTYLA.

FAMILY CERVIDÆ. DEER, MOOSE, ELK, CARIBOU, ETC.

SUBFAMILY CERVINÆ.

GENUS **ODOCOILEUS.**

Odocoileus virginianus (BODD.). Virginia Deer, White-tailed Deer.
Odocoileus virginianus borealis (MILLER). Northern White-tailed Deer.

GENUS **CERVUS.**

Cervus canadensis (ERXLEBEN). American Elk.

GENUS **PARALCES.**

Paralces americanus (CLINTON). Moose.

GENUS **RANGIFER.**

Rangifer caribou (GMEL.). Woodland Caribou.

FAMILY BOVIDÆ. BISON, OXEN, SHEEP, ETC.

SUBFAMILY BOVINÆ.

GENUS **BISON.**

Bison bison (LINN.). American Bison or Buffalo.

ORDER GLIRES.

SUBORDER SIMPLICIDENTATA.

FAMILY SCIURIDÆ. SQUIRRELS, WOODCHUCKS, ETC.

SUBFAMILY PTEROMYINÆ.

GENUS **SCIUROPTERUS.**

SUBGENUS GLAUCOMYS.

Sciuropterus volans (LINN.). Southern Flying Squirrel.
Sciuropterus sabrinus (SHAW). Northern Flying Squirrel.

SUBFAMILY SCIURINÆ.

GENUS **SCIURUS.**

SUBGENUS PARASCIURUS.

Sciurus niger rufiventer (GEOFFROY). Western Fox Squirrel.

SUBGENUS NEOSCIURUS.

Sciurus carolinensis GMELIN. Southern Gray Squirrel.
Sciurus carolinensis leucotis (GAPPER). Northern Gray Squirrel.

SUBGENUS TAMIASCIURUS.

Sciurus hudsonicus loquax BANGS. Southern Red Squirrel.

GENUS **TAMIAS.**

Tamias striatus (LINN.). Chipmunk.
Tamias striatus griseus MEARNS. Gray Striped Chipmunk.

GENUS **EUTAMIAS.**

Eutamias borealis neglectus (ALLEN). Little Chipmunk.

SUBFAMILY MARMOTINÆ.

GENUS **CITELLUS.**

SUBGENUS ICTIDOMYS.

Citellus tridecemlineatus (MITCHILL). Striped Ground Squirrel, "Gopher."
Citellus franklini (SABINE). Franklin's Ground Squirrel, "Gray Gopher."

GENUS **MARMOTA.**

Marmota monax (LINN.). Woodchuck.
Marmota monax canadensis (ERXLEBEN). Canada Woodchuck.

FAMILY CASTORIDÆ. BEAVERS.

GENUS **CASTOR.**

Castor canadensis KUHL. Beaver.

FAMILY MURIDÆ. RATS AND MICE.

SUBFAMILY MURINÆ.

GENUS **MUS.**

Mus musculus LINN. House Mouse.

GENUS **EPIMYS.**

Epimys norvegicus (ERXLEBEN). Norway Rat, House Rat.
[*Epimys rattus* (LINN.). Black Rat.]

SUBFAMILY CRICETINÆ.

GENUS **PEROMYSCUS.**

SUBGENUS PEROMYSCUS.

Peromyscus leucopus (RAFIN.). White-footed Mouse.
Peromyscus leucopus noveboracensis (FISCHER). Northern White-footed Mouse.
Peromyscus maniculatus bairdi (HOY AND KENNICOTT). Prairie White-footed Mouse.
Peromyscus maniculatus gracilis (LECONTE). Canadian White-footed Mouse.
Peromyscus gossypinus megacephalus (RHOADS). Western Cotton Mouse.

SUBGENUS OCHROTOMYS.

Peromyscus nuttalli aureolus (AUD. AND BACH.). Southern Golden Mouse.

GENUS **REITHRODONTOMYS.**

[*Reithrodontomys dychei* ALLEN. Dyche's Harvest Mouse.]

GENUS **ORYZOMYS.**

Oryzomys palustris (HARLAN). Rice Field Mouse.

SUBFAMILY NEOTOMINÆ.

GENUS **NEOTOMA.**

SUBGENUS NEOTOMA.

Neotoma floridana illinoensis HOWELL. Illinois Wood Rat.

SUBFAMILY MICROTINÆ.

GENUS **EVOTOMYS.**

Evotomys gapperi (VIGORS). Red-backed Mouse or Vole.

GENUS **MICROTUS.**

SUBGENUS MICROTUS.

Microtus pennsylvanicus (ORD). Meadow Mouse or Vole.

SUBGENUS PEDOMYS.

Microtus ochrogaster (WAGNER). Prairie Meadow Mouse or Vole.
[*Microtus minor* MERRIAM. Little Meadow Mouse or Vole.]

SUBGENUS PITYMYS.

Microtus pinetorum scalopsoides (AUD. AND BACH.). Mole Mouse or Mole-like Vole.

GENUS **FIBER.**

Fiber zibethicus (LINN.). Muskrat.

GENUS **SYNAPTOMYS.**

SUBGENUS SYNAPTOMYS.

Synaptomys cooperi BAIRD. Cooper's Lemming Mouse.]*
Synaptomys cooperi gossii (MERRIAM). Goss's Lemming Mouse.
Synaptomys cooperi fatuus (BANGS). Bangs's Lemming Mouse.

FAMILY GEOMYIDÆ. POCKET GOPHERS.

GENUS **GEOMYS.**

Geomys bursarius (SHAW). Pocket Gopher.

FAMILY ZAPODIDÆ. JUMPING MICE.

SUBFAMILY ZAPODINÆ.

GENUS **ZAPUS.**

Zapus hudsonius (ZIMM.). Hudson Bay Jumping Mouse.

GENUS **NAPÆOZAPUS.**

[*Napæozapus insignis* (MILLER). Woodland Jumping Mouse.]

*I have seen no typical specimens of *S. cooperi* from Illinois, but specimens from the east central part of the state are intermediate between *cooperi* and *gossii*.

FAMILY ERETHIZONTIDÆ. AMERICAN PORCUPINES.

SUBFAMILY ERETHIZONTINÆ.

GENUS **ERETHIZON.**

Erethizon dorsatum (LINN.). Canada Porcupine.

SUBORDER DUPLICIDENTATA.

FAMILY LEPORIDÆ. HARES AND RABBITS.

GENUS **LEPUS.**

SUBGENUS LEPUS.

Lepus americanus phæonotus ALLEN. Varying Hare, Snow-shoe Rabbit.
[*Lepus campestris* BACHMAN. Jackass Rabbit, "Jack Rabbit."]

GENUS **SYLVILAGUS.**

SUBGENUS SYLVILAGUS.

Sylvilagus floridanus mearnsii (ALLEN). Mearns's Cotton-tail Rabbit, Gray Rabbit

SUBGENUS TAPETI.

Sylvilagus aquaticus (BACHMAN). Swamp Rabbit.

ORDER FERÆ.

SUBORDER FISSIPEDIA.

FAMILY FELIDÆ. THE CATS.

SUBFAMILY FELINÆ.

GENUS **FELIS.**

Felis couguar KERR. Panther, Cougar.

GENUS **LYNX.**

SUBGENUS LYNX.

Lynx canadensis KERR. Canada Lynx.

SUBGENUS EUCERVARIA.

Lynx ruffus (GÜLDEN.). Wild Cat, Bay Lynx.

FAMILY CANIDÆ. WOLVES AND FOXES.

GENUS **UROCYON.**

Urocyon cinereoargenteus (SCHREBER). Gray Fox.
Urocyon cinereoargenteus ocythous BANGS. Wisconsin Gray Fox.

GENUS **VULPES.**

Vulpes fulvus (DESMAREST). Red Fox.

GENUS **CANIS.**

Canis nubilus SAY. Gray Wolf, Timber Wolf.
Canis latrans SAY. Prairie Wolf, Coyote.

FAMILY MUSTELIDÆ.

SUBFAMILY LUTRINÆ. OTTERS.

GENUS **LUTRA.**

Lutra canadensis (SCHREBER). Canada Otter.

SUBFAMILY MELINÆ. SKUNKS AND BADGERS.

GENUS **MEPHITIS.**

Mephitis hudsonica (RICH.). Northern Skunk, Hudsonian Skunk.
Mephitis mephitis avia (BANGS). Illinois Skunk.
[*Mephitis mephitis* (SCHREBER). North-eastern Skunk.]

GENUS **SPILOGALE.**

Spilogale putorius (LINN.). Alleghenian Spotted Skunk.
[*Spilogale interrupta* (RAFIN.). Prairie Spotted Skunk.]

GENUS **TAXIDEA.**

Taxidea taxus (SCHREBER). American Badger.

SUBFAMILY MUSTELINÆ. WEASELS, MINK, WOLVERINE, ETC.

GENUS **GULO.**

Gulo luscus (LINN.). Wolverine.

GENUS **PUTORIUS.***

SUBGENUS LUTREOLA.

Putorius vison lutreocephalus (HARLAN). Mink.

SUBGENUS ICTIS.

Putorius noveboracensis EMMONS. New York Weasel.
† *Putorius longicauda spadix* BANGS. Minnesota Long-tailed Weasel.
Putorius cicognanii (BONAP.). Bonaparte's Weasel.
Putorius rixosus allegheniensis (RHOADS). Alleghenian Least Weasel.

GENUS **MUSTELA.**‡ MARTENS, ETC.

Mustela americana TURTON. Marten, Pine Marten.
Mustela pennanti ERXLEBEN. Fisher, Pennant's Marten.

FAMILY PROCYONIDÆ. RACCOONS.

SUBFAMILY PROCYONINÆ.

GENUS **PROCYON.**

Procyon lotor (LINN.). Raccoon.

FAMILY URSIDÆ. BEARS.

GENUS **URSUS.**

Ursus americanus PALLAS. Black Bear.

*According to Thomas (Proc. Zool. Soc. Lond., 1911, p. 139), the name *Putorius* commonly used for this genus must be changed to *Mustela*.

†Specimens from Wisconsin are not typical but seem to approach nearer to *spadix* than to any othe recognized form.

‡According to Thomas (Proc. Zool. Soc. Lond., 1911, p. 139), the name *Mustela* commonly used for this genus must give place to *Martes*.

ORDER INSECTIVORA.

SUBORDER INSECTIVORA VERA.

FAMILY SORICIDÆ. SHREWS.

SUBFAMILY SORICINÆ.

GENUS **SOREX.**

SUBGENUS SOREX.

Sorex personatus GEOFFROY ST. HILIARE. Common Shrew.
Sorex richardsonii BACHMAN. Richardson's Shrew.
Sorex fumeus MILLER. Smoky Shrew.
Sorex longirostris BACHMAN. Carolina Shrew.

GENUS **MICROSOREX.**

Microsorex hoyi (BAIRD). Hoy's Shrew.

GENUS **NEOSOREX.**

Neosorex palustris (RICH.). Marsh Shrew, Water Shrew.

GENUS **BLARINA.**

SUBGENUS BLARINA.

Blarina brevicauda (SAY). Short-tailed Shrew, Mole Shrew.
Blarina brevicauda carolinensis (BACHMAN). Carolina Short-tailed Shrew.

SUBGENUS CRYPTOTIS.

Blarina parva (SAY). Small Short-tailed Shrew.

FAMILY TALPIDÆ. MOLES.

SUBFAMILY TALPINÆ.

GENUS **SCALOPUS.**

Scalopus aquaticus machrinus (RAFIN.). Prairie Mole.

GENUS **CONDYLURA.**

Condylura cristata (LINN.). Star-nosed Mole.

ORDER CHIROPTERA.

SUBORDER MICROCHIROPTERA.

FAMILY VESPERTILIONIDÆ. TYPICAL BATS.

SUBFAMILY VESPERTILIONINÆ.

GENUS **MYOTIS.**

Myotis lucifugus (LECONTE). Little Brown Bat.
Myotis grisescens HOWELL. Gray Bat.
Myotis subulatus (SAY). Say's Bat.

GENUS **LASIONYCTERIS.**

Lasionycteris noctivagans (LECONTE). Silver-haired Bat.

GENUS **PIPISTRELLUS.**

Pipistrellus subflavus (F. CUVIER). Georgian Bat.

GENUS **EPTESICUS.**

Eptesicus fuscus (BEAUVOIS). Brown Bat.

GENUS **NYCTERIS.**

Nycteris borealis (MÜLLER). Red Bat.
Nycteris cinereus (BEAUVOIS). Hoary Bat.

GENUS **NYCTICEIUS.**

Nycticeius humeralis (RAFIN.). Rafinesque Bat.

GENUS **CORYNORHINUS.**

[*Corynorhinus macrotis* (LECONTE). Big-eared Bat.]

FAMILY MOLOSSIDÆ. FREE-TAILED BATS.

GENUS **NYCTINOMUS.**

[*Nyctinomus depressus* (WARD). Free-tailed Bat.]

ORDER PRIMATES.

SUBORDER ANTHROPOIDEA.

FAMILY HOMINIDÆ. MAN.

GENUS **HOMO.**

Homo sapiens americanus (LINN). American Indian.

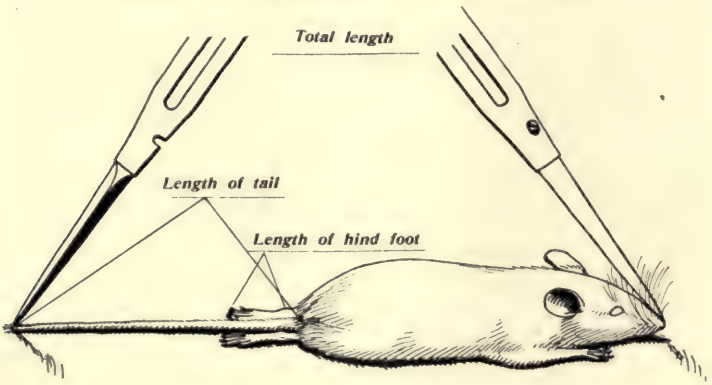
HOW TO ESTIMATE THE AGE OF A MAMMAL.*

For purposes of identification it is often essential for the student to know whether an animal is old or young, as many species vary greatly in appearance at different ages. In some cases he will learn to recognize immature specimens by their smaller size and the difference in the color of their pelage; but in others, where the pelage differs but little, or the young animal has nearly attained its full growth, an approximate idea of its age can best be formed by reference to anatomical characters, such as the degree of ossification and anchylosis of the epiphyses, the condition of the cranial sutures and of the teeth.

In the young animal the epiphyses are cartilaginous, but in most cases they gradually ossify and ultimately (usually at the age of maturity) become anchylosed to the main part of the bone. The cranial sutures, which in the immature animal have the appearance of "cracks" in the skull, gradually become anchylosed, and in advanced age their line of union is often but faintly indicated and in many cases, by the ossification of the intervening tissue, become entirely obliterated. If the edges of the bones are notched, so as to interlock, the union is called a *dental suture;* but, if they are bevelled and overlap, the union is a *squamous suture.*

Deciduous teeth, or "milk teeth," are present in the young in most species; later they are replaced by permanent teeth. At the age of maturity the permanent teeth are usually in perfect condition, but in old specimens they are much worn.

HOW TO MEASURE A MAMMAL.



LENGTH — Distance from end of nose to end of vertebræ of tail (not including the hairs which may extend beyond).

* For definitions of terms, see Glossary, p. 489.

TAIL VERTEBRÆ OR TAIL — Distance from point where it joins the body to the tip (not including the hairs which may extend beyond).

HIND FOOT — Distance from the heel (tarsal joint) to the end of the longest claw.

EAR — Distance from point where it joins the skull to the tip (this is the method followed in the present work; some persons measure from the *notch* to the tip).

LIFE ZONES.

Naturalists have learned that the surface of the earth is divisible into regions representing the distribution of the various forms of animal and plant life, which, it has been found, is governed by variations in temperature. Dr. C. Hart Merriam says: "Investigations conducted by the Biological Survey have shown that the northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures of the entire season of growth and reproduction, and that the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year."

The North American continent is divided into three great primary regions: (1) The Boreal Region, comprising the Arctic, Hudsonian, and Canadian zones; (2) The Austral Region, which contains the Transition, Upper Austral and Lower Austral zones; and (3) The Tropical Region, the last being represented in the United States only in southern Florida and a portion of Texas.

The more humid portions of the Austral zones lying east of the Great Plains (approximately east of the 100th meridian of longitude) are divided into faunal areas, or faunas, known respectively, as the Alleghanian, Carolinian and Austroriparian faunas.

The Arctic Zone — This zone lies far north, beyond the limit of tree growth, but is also represented in more southern localities on high mountains above the line of timber, where it is designated as Arctic-alpine.

Hudsonian Zone — This comprises the most northern forested regions of the continent, and is largely covered with firs and spruces. It is represented in more southern localities on the upper wooded slopes of high mountains in the United States, where similar climatic conditions obtain, and is there termed Hudsonian-alpine.

Canadian Zone — This comprises the more southern portion of the coniferous forest regions of Canada and the northern parts of Wisconsin, Michigan and New England. Under the name of Canadian-alpine it also includes portions of mountains in the United States and Mexico, situated at an altitude where similar climatic conditions exist.

Transition Zone — This zone is characterized by comparatively few distinctive animals and plants, but covers a territory which represents the southern limit of many northern species and the northern limit of many more southern species.

Upper Austral, Lower Austral and Tropical Zones — In the Upper Austral Zone we find trees such as oaks, hickories, chestnuts, etc., in abundance, which are gradually succeeded by persimmons, magnolias, cyprus, etc., in the Lower Austral Zone; and again by palms, bananas, etc., in the Tropical Zone, which in eastern United States is represented only in southern Florida. As with the plant life, there is a corresponding change in the fauna of these different zones,

Map showing Life Zones in eastern North America, from Hudson Bay to the Gulf of Mexico. Copied from the U. S. Biological Survey's Fourth Provisional Zone Map of North America prepared by C. Hart Merriam, Vernon Bailey, E. W. Nelson, and E. A. Preble, 1910.

but the limits of the latter are not so clearly marked as in the former, inasmuch as animals have the power of moving about at will and with few exceptions are not confined to one locality throughout the year. The ranges of many species of mammals are often not restricted to one zone, but may include a portion of two or more.

It is important that the student should become familiar with the location of these zones, as reference to them is often made by writers in describing the distribution of species.*

* To students, who desire to pursue this important subject further, the following publications are recommended:

WALLACE, A. R. Geographical Distribution of Animals, I and II, New York, 1876.
ALLEN, J. A. Geographical Distribution of the Mammalia. Bull. U. S. Geol. and Geogr. Surv. Terr., IV, No. 2, 1878, pp. 313–377.
ALLEN, J. A. Geographical Distribution of N. Amer. Mammals. Bull. Amer. Mus. Nat. Hist., IV, 1892, pp. 199–243.
MERRIAM, C. H. Geographical Distribution of Life in N. Amer. Proc. Biol. Soc. Wash., VII, 1892, pp. 1–64.
MERRIAM, C. H. Life Zones and Crop Zones of the U. S. U. S. Dept. Agric., Div. Biol. Surv., Bull. No. 10, 1898.

KEY TO THE ORDERS AND FAMILIES

REPRESENTED WITHIN OUR LIMITS.

KEY TO THE ORDERS.

1. Fingers greatly elongated, supporting a leathery membrane which serves as a wing. **Order CHIROPTERA,** p. 445.

2. Fingers not greatly elongated and not supporting a leathery membrane which serves as a wing.

A. Feet provided with hoofs. **Order UNGULATA,** p. 57.

B. Feet provided with claws or nails.

b1. No canine teeth present; a wide gap between cheek teeth and incisors; front teeth (incisors) large and chisel-shaped, never more than two in lower jaw. **Order GLIRES,** p. 97.

b2. Canine teeth present and prominent, longer and noticeably different from the others.

Tail and ears nearly or quite naked (hairless); female with external abdominal pouch. **Order MARSUPIALIA,** p. 49.

Tail and ears not naked; female without abdominal pouch. **Order FERÆ,** p. 275.

b3. Canine teeth present but not prominent and but little different from others; teeth continuous, with no wide gap between them; upper lip projecting beyond lower; snout long. **Order INSECTIVORA,** p. 405

KEY TO THE FAMILIES.

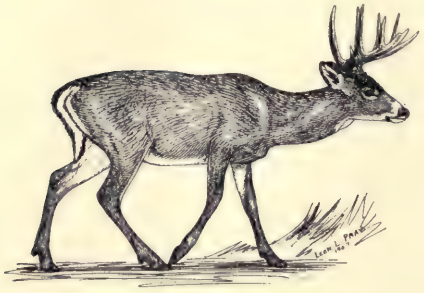
GROUP 1. Order MARSUPIALIA. Pouched Mammals.

Tail nearly naked; ears naked; general color grayish white; teeth 50; canine teeth present; hind foot with five toes, the innermost one shaped like a thumb and without claw; female with external abdominal pouch for carrying young after birth. A single species occurs within our limits, which is about the size of a large Domestic Cat.

Family DIDELPHIIDÆ. Opossums, p. 51.

GROUP 2. Order UNGULATA. Hoofed Mammals.

SECTION 1. Horns branched and solid (not hollow) and annually shed.

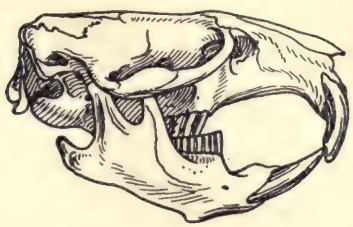


Family CERVIDÆ.
Deer, Moose, Caribou, etc., p. 58.

SECTION 2. Horns simple (not branched), permanent (not annually shed), and more or less hollow.

Family BOVIDÆ.
American Bison or Buffalo, etc., p. 86.

GROUP 3. Order GLIRES. Gnawing Mammals. Squirrels, Rabbits, Rats, Beavers, etc.



Skull of a Rodent.

Front teeth (incisors) large and chisel-shaped and separated from the molars on side of jaw by a wide gap; canine teeth absent; toes with nails or claws.

SECTION 1. Upper front teeth (incisors) **2**.

PART 1. Tail very broad and flat (paddle-shaped) and without hair; hind toes broadly webbed; total length of adult 3 feet or more.

Family CASTORIDÆ. Beavers, p. 158.

PART 2. Body more or less covered with sharp, stiff quills; tail not flat and naked; total length of adult 2 feet or more.

Family ERETHIZONTIDÆ. American Porcupines, p. 253.

PART 3. Tail not broad, flat and naked, and no sharp quills on body.

A. Four or more developed grinding teeth (molars and premolars) on side of each jaw.

a1. Tail thickly haired or bushy; cheek pouches (when present) opening inside of mouth.

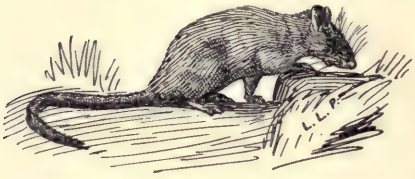
Family SCIURIDÆ. Squirrels, Woodchucks, etc., p. 98.

a2. Tail not thickly haired; cheeks with large external pouch opening outside of mouth; front of incisors deeply grooved; claws on fore feet very long.

Family GEOMYIDÆ. Pocket Gophers, p. 239.

B. Not more than 3 well developed grinding teeth on side of jaw; tail closely haired, or in some species nearly or quite naked.

b1. Hind feet ordinary, not greatly elongated.



Family MURIDÆ. Rats and Mice, p. 171.

b2. Hind feet much elongated; tail very long; size small (in one species a very small premolar is present in addition to the three well developed molars).

Family ZAPODIDÆ. Jumping Mice, p. 246.

SECTION 2. Upper front teeth (incisors) **4**; two large incisors and two very small ones directly behind them; ears and hind legs noticeably long.

Family LEPORIDÆ. Hares and Rabbits, p. 259.

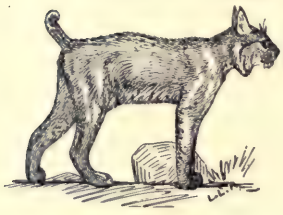
GROUP 4. Order FERÆ. Flesh Eaters. Bears, Cats, Wolves, Skunks, Weasels, etc.

Skull of Wild Cat showing canine teeth.

Canine teeth present and prominent, longer and noticeably different from the others; front teeth (incisors) comparatively small; toes with claws.

SECTION 1. Hind foot with 4 toes.

PART 1. Shape, cat-like; toes armed with sharp claws, which are retractile (capable of being extended or drawn back as in a sheath); teeth 30 or less.



Family FELIDÆ. Cats, Lynxes, Panthers, etc. p. 277.

PART 2. Shape, dog-like; claws not retractile; teeth 42; muzzle long.

Family CANIDÆ. Wolves, Foxes, etc. p. 296.

SECTION 2. Hind foot with 5 toes.

PART 1. Size large, 200 to 300 lbs. or more; fur black; teeth 42; practically entire sole of foot touches the ground when walking (plantigrade).

Family URSIDÆ. Bears, p. 396.

PART 2. Size medium; tail bushy, showing several distinct dark rings (annulated); practically entire sole of foot touches the ground when walking (plantigrade).

Family PROCYONIDÆ. Raccoons, p. 391.

PART 3. Size variable in different species; tail hairy but never showing several distinct rings or bars; sole of foot not touching the ground when walking.

Family MUSTELIDÆ. Otters, Skunks, Minks, Weasels, Martens, Wolverine and Badgers. p. 327.

GROUP 5. Order INSECTIVORA. Insect Eaters.

Size small, the largest (in our species) less than 10 inches long; snout long, upper lip noticeably projecting beyond the lower; canine teeth present but not noticeably prominent, and differing but little from the others; tooth row practically continuous, with no wide gap as in Glires; eyes very small, often rudimentary; ears concealed except in one genus; toes with claws.

SECTION 1. No external ear; front feet very large and wide; claws large; fur thick and soft; length more than 5 inches.

Family TALPIDÆ. Moles, p. 433.

SECTION 2. External ear present but small and in some species concealed by fur; feet normal, front ones not conspicuously large; somewhat resembles a small Mouse but snout much more elongated and slender.

Family SORICIDÆ. Shrews, p. 406.

GROUP 6. Order CHIROPTERA. Bats.

Fore limbs modified and fingers greatly elongated, supporting a leathery membrane which is attached to the hind limbs and body and forms a wing.

Body covered with soft fur; wings more or less bare. Most of our Bats are comparatively small and they are often observed flying about in the evening.

Family VESPERTILIONIDÆ. Bats, p. 445.

ORDER MARSUPIALIA.

MARSUPIALS.

The Marsupials, or so-called Pouched Mammals, comprise a large number of curious animals, including the Kangaroos, Wombats, etc., and are mostly confined to the Australian region. They are represented, however, in the new world by the Opossums (*Didelphiidæ*), a number of species of which are found in North and South America; and also in the latter country by *Caenolestes*,* a representative of the, until lately, supposed extinct family *Epanorthidæ*.

As the name marsupial implies, in many cases the female is furnished with an external abdominal pouch in which the young, which are born in a very incomplete stage of development,† are placed by the mother and suckled until they are sufficiently grown to be able to move about by themselves. In *Phascologale*, however, the pouch is only present in rudiment, and it is apparently entirely absent in *Myrmecobius*. In the American members of the order the pouch is often absent, sometimes rudimentary, and occasionally well developed

Some Marsupials are herbivorous, others insectivorous, and a few are carnivorous. The North American Opossums seem to be practically omnivorous. Members of the family are terrestrial, arboreal or burrowing, and one (*Chironectes*), a small Central and South American species, has webbed hind feet and is semiaquatic.

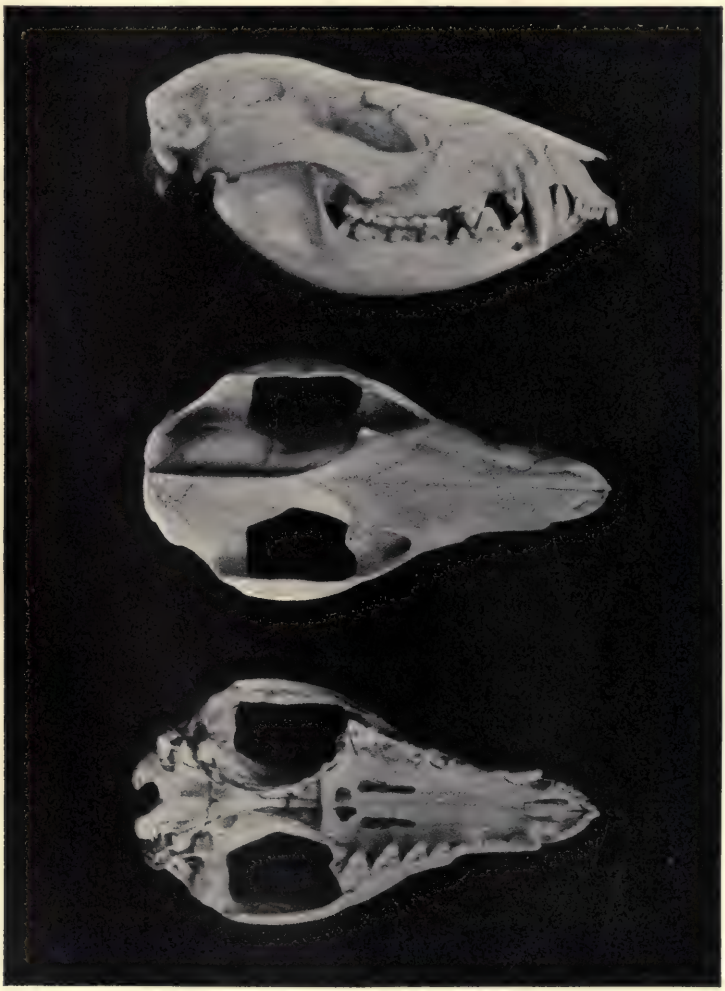
Among members of this order usually only one tooth of the milk set is functional, the fourth premolar; a developed clavicle is always present. There are differences in brain characters which distinguish Marsupials from higher mammals, among which is the almost total absence of a true *corpus callosum*. The cloaca is reduced and shallow. A true allantoic placenta is rarely present (so far as known, only in *Parameles*). The uterus and vagina are double. The mammæ vary in number but are

* A number of specimens of this little known Marsupial were taken by Mr. W. H. Osgood in the mountains of western Venezuela and eastern Colombia in the spring of 1911. Study of this material is now under way and will be the subject of a special paper which will appear later in the Publications of this Museum.

† Flower and Lydekker say, "In this stage of their existence they are fed by milk injected into their stomach by the contraction of the muscles covering the mammary gland, the respiratory organs being modified temporarily, much as they are permanently in the Cetacea, the elongated upper part of the larynx projecting into the posterior nares, and so maintaining a free communication between the lungs and the external surface independently of the mouth and gullet, thus averting the danger of suffocation while the milk is passing down the latter passage." (Mammals Living and Extinct, 1891, pp. 130–131.)

always abdominal. In the male the usual positions of the external genital organs are transposed; a cæcum is present, but small.

Marsupials possess a number of characters which have puzzled naturalists as to their origin, as in some ways they resemble Prototherian mammals and in others Eutherian, but the balance of evidence seems to indicate a much nearer relationship to the latter, and it is probable that they are derived from some primitive form of Eutherian mammal, having, in Beddard's opinion, "separated from the Eutherian stock after it had acquired a definite diphyodonty and the allantoic placenta."*



Skull of Opossum (*Didelphis virginiana*).
(About ½ nat. size.)

* Mammalia, 1902, p. 119.

SUBORDER POLYPROTODONTIA.

Family DIDELPHIIDÆ. Opossums.

The members of this family are confined to North, Central and South America. They are pentadactylous and the tail is usually long and prehensile. The majority are arboreal and mainly insectivorous, but many of the larger species eat birds, eggs, reptiles, etc., and one tropical species is semiaquatic and is said to subsist largely upon fish. Our species of Opossum seems to be practically omnivorous.

The teeth are 50 in number. The single species which occurs within our limits has a well developed abdominal pouch, but, as has been previously stated, in some members of the family it is more or less rudimentary, being merely composed of two lateral folds of skin separated at each end, while in others it is entirely absent.

Genus **DIDELPHIS** Linn.

Didelphis Linnæus, Syst. Nat., X ed., I, 1758, p. 54. Type (by elimination) *Didelphis marsupialis* Linn.

External abdominal pouch, into which the teats open, well developed; feet with five toes; the hind feet with inner toe thumb-like, without nail and opposable to the others; ears and tail largely naked, the latter prehensile; skull with sagittal and occipital crests strongly developed; incisors small and pointed; premolars with compressed, pointed crowns; canines large; gape of mouth very large; bristles on nostrils and lips, long.

Dental formula: $1\ \frac{5-5}{4-4}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{4-4}{4-4} = 50$.

Didelphis virginiana KERR.

VIRGINIA OPOSSUM.

Didelphis marsupialis LINN., Syst. Nat., X ed., I, 1758, p. 54 (in part only).

Didelphis virginiana KERR, Anim. Kingd., 1792, p. 173. HAYMOND, Rept. Geol. Surv. Ind., 1869, p. 205 (Indiana). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 7 (Kentucky). ALLEN, Bull. Amer. Mus. Nat. Hist., XIV, 1901, p. 162 (Illinois, Tennessee, Missouri, etc.). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 71 (Missouri). *Ib.*, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 14 (Wisconsin). MCATEE, Proc. Biol. Soc. Wash., XX, 1907, p. 2 (Indiana). HAHN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 456 (N. W. Indiana). *Ib.*, Proc. U. S. Nat. Mus., XXXV, 1908, p. 568 (S. Indiana). *Ib.*, Ann. Rep. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 448 (Indiana). EVERMANN & CLARK, Proc. Wash. Acad. Sci., XIII, 1911, p. 2 (Indiana).

Didelphus Virginiana LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 337 (Wisconsin).

Didelphys Virginianus R. KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 580 (Cook Co., Illinois).

Didelphys Virginiana THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 656 (Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 440 (Wisconsin).

Didelphys virginiana MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 220 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 194 (Iowa). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 44 (Iowa). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 513 (Champaign Co., Illinois).

Didelphis Virginiana HOY, Trans. Wis. Acad. Sci., Arts & Letters, V, 1882, p. 256 (Wisconsin).

Type locality — Virginia.

Distribution — Eastern United States (except Florida and the coast region of the Gulf states, where a slightly different form occurs), north to Long Island and New York, and west, south of the Great Lakes, to southern Michigan, southern Wisconsin and Iowa, thence southward to eastern Texas.

Description — Adult: General color grayish white, the under fur with blackish tips and overlaid with long white hairs; legs blackish; feet black, with partly white toes; whole of the head, throat, and sides of the neck white, sometimes tinged with yellowish; at times a narrow blackish eye ring and usually a small blackish spot in front of the eye; ears black and nearly naked, edged with flesh color; tail nearly naked, dull flesh color becoming blackish at the base; toe nails and soles of feet flesh color; inner toe of hind foot thumb-like and without nail. Female with external abdominal pouch into which the 13 teats open and in which the young are carried and nourished after birth; pouch lined with soft brownish woolly hair.

Measurements — Length, about 26 to 33 in. (680 to 850 mm.); tail, 11 to 13.50 in. (280 to 345 mm.).

The Virginia Opossum is common in wooded localities in southern Illinois and occurs sparingly in northern Illinois and southern Wisconsin. In the latter state Moses Strong states it was "found occasionally in the vicinity of Lake Michigan" (*l.c.*, p. 440); Hollister records three specimens having been killed in Walworth County during the past fifteen years (*l. c.*, p. 137); Jackson states that three specimens were taken in Green County, one in January, 1902, and two in the autumn of 1906. Dr. Hoy writes, "The Opossum were not uncommon in Racine and Walworth counties as late as 1848. They have been caught as far north as Waukesha and one near Madison in 1872, since which time I have not heard of any being taken. I am told that a few are still found in Grant

County" (*l. c.*, p. 257). Mr. W. E. Snyder has a male specimen in his collection taken near Beaver Dam, Dodge County, Wisconsin, May 9,

Virginia Opossum (*Didelphis virginiana*).

1907, and he informs me an Opossum was killed near Columbus, Columbia County, in the fall of 1905.

Kennicott states that the Opossum was at one time not uncommon in Cook County, Illinois (*l. c.*, p. 580). Mr. John F. Ferry procured two specimens alive in the fall of 1907, which were trapped on an

island in Rock River near Oregon, Ogle County, northwestern Illinois. It has also been taken in the vicinity of Glen Ellyn, Du Page County, Illinois, by Mr. B. T. Gault, who writes, "An Opossum was found dead in our woods February 19, 1910, evidently having been killed by dogs. It was quite badly mutilated and the fur slipped considerably, probably having been dead some time. Another one was killed here New Year's day and the man who did it tells me he has taken two others within the past ten years." I have seen a specimen killed near the Kankakee River not far from the Indiana line, and another from the vicinity of Warsaw, Hancock County, Illinois. It is also recorded by Dr. J. A. Allen from the latter locality (*l. c.*, p. 162). Farther south it becomes more common and is reported from various places in southern Illinois. The Field Museum collection contains specimens taken near Bogota, Jasper County, and Olive Branch, Alexander County.

The Opossum is very prolific; usually two and sometimes three litters are born in a season and the young usually number from 8 to 13 in a litter. When born they are extremely small, considerably less than an inch in length, imperfectly developed, naked and absolutely helpless. They are immediately placed in the pouch by the mother, where they attach themselves to the nipples and remain so for several weeks until sufficiently grown to be able to move about and help themselves. When they are able to leave the pouch, they are often carried about on the back of the old Opossum, clinging to her fur and with their tails wrapped around that of their mother, which she obligingly holds over her back for the purpose.

Opossums are nocturnal in their habits, although I have occasionally met with one wandering about in the woods in the day time. They move slowly when on the ground and

when surprised often lie perfectly still and pretend to be dead, "playing possum" as it is called. They will then usually permit themselves to be lifted by the tail and for a short time will hang limp and motionless; but care should be taken not to trust them too far, for their teeth are very sharp, and they can bite viciously when once they have made up their minds to do so. The Opossum usually makes its home in a hollow tree, log or stump, although it occasionally prefers a hole in the ground. It is omnivorous, eating almost anything in the way of food, including birds and eggs, mice, frogs, fish, insects and fruit of various kinds. Audubon and Bachman say: "It enters the corn fields (maize), crawls up the stalks, and sometimes breaks them down in the manner of a raccoon, to feed on the young and tender grains; it picks up chestnuts, acorns, chinquapins and beech nuts, and munches them in the manner of a bear. We have, on dissection, ascertained that it had devoured blackberries, whortleberries, and wild cherries, and its resort to the persimmon tree is proverbial. It is also insectivorous, and is seen scratching up the leaves in search of worms, and the larvæ of insects, of which it is very fond. In early spring it lays the vegetable kingdom under contribution for its support, and we have observed it digging up the roots of the small atamàmasco lily (*Zepherina atamasco*), and the young and tender shoots of the China brier (*Smilax rotundifolia*), as they shoot out of the ground like asparagus. It is moreover decidedly carnivorous, eating young birds that it may detect on the ground, sucking the eggs in all the partridge, towhee bunting and other nests, it can find in its persevering search. It destroys mice and other rodentia, and devours whole broods of young rabbits, scratching about the nest and scattering the hair and other materials of which it was composed. . . . We must admit that it sometimes makes a sly visit to the poultry house, killing a few of the hens and playing havoc among the eggs. The annoyances of the farmer, however, from this mischievous propensity, are not as great as those sustained from some of the other species, and cannot for a moment be compared with the destruction caused by the weasel, the mink, or the skunk."* The flesh is esteemed by many people, especially negroes, but it has a peculiar oily flavor which is not always agreeable. The skin when dyed makes a not unattractive fur.

Specimens examined from Illinois and Wisconsin:

Illinois — Olive Branch, Alexander Co., 2; Bogota, Jasper Co., 5; "Illinois" (adult and juv.), 8; (O.) Oregon, Ogle Co., 2; Warsaw, Hancock Co., 1; Kankakee River, 1 = 19.

Wisconsin — (S. C.) Beaver Dam, Dodge Co., 1.

*Quadrupeds N. Amer., II, 1854, pp. 112–113.

Map illustrating approximate distribution of Opossums in eastern United States. Stragglers occasionally occur slightly farther north.

Didelphis virginiana KERR. Type locality — Virginia. Description as previously given.

Didelphis v. pigra BANGS. (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 172.) Type locality — Oak Lodge, opposite Micco, Brevard Co., Florida. Similar but smaller and somewhat darker than *virginiana;* tail longer and more slender.

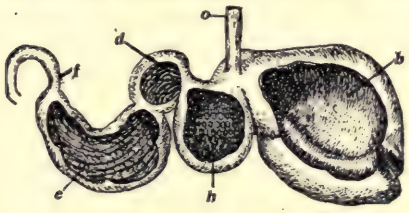
ORDER UNGULATA.

HOOFED MAMMALS.

This order comprises the Hoofed Mammals, such as Deer, Oxen, Horses, Sheep, Swine, Elephants, etc.,* representatives of the various families being widely distributed throughout the world, except in Australia and Madagascar. They are terrestrial, digitigrade, and vegetarian. The molars are broad, with ridged or tuberculate surfaces; the teeth are heterodont or diphyodont; and the "milk teeth" remain longer than in most mammals; clavicles are not present in living species; the digits vary from one to five, and are usually incased in a horny hoof, although in some cases, such as the Elephants, there are broad blunt nails.

The American Ungulates belong to two suborders: Perissodactyla, those having an uneven number of toes, such as the Horse and Tapir; and Artiodactyla, those possessing an even number of toes, such as Deer, Oxen, Sheep, etc. The latter are characterized by the prominence of the third and fourth digits, while the second and fifth are indicated by small lateral hoofs, or "false hoofs," which are rarely, if ever, functional, and in some species are entirely absent.

The suborder Artiodactyla is generally divided into two groups or divisions consisting of (1) the Suinea, comprising the families containing the Swine and Hippopottami; and (2) the Selenodontia, or Ruminantia,† comprising the other representatives of the suborder, such as Deer, Oxen, Sheep, etc., which ruminate or "chew their cud."



Stomach of Ruminant.
o, Œsophagus; b, rumen or pouch; h, reticulum or honeycomb bag; d, psalterium or manyplies; c, abomasum or reed; f, duodenum. (After Flower and Lydekker.)

In all "ruminants" the stomach is usually divided into four compartments (in the *Tragulidæ* there are but three), and the operation consists of forcing back the hastily and improperly chewed grass or vegetable matter from the stomach into the mouth, where the food is

* See page 28.

† The Ruminantia are again subdivided into somewhat natural groups: (1) *Tragulina*, comprising the Chevrotains or Deerlets; (2) *Tylopoda*, Camels, Llamas, Vicuñas, etc.; and (3) *Pecora*, including the families *Cervidæ*, Deer, etc.; *Giraffidæ*, Giraffes and Okapi; and *Bovidæ*, Oxen, Sheep, Goats, Old World Antelopes and not unlikely the American Antelope or Pronghorn, although the last is usually placed in a family by itself (*Antilocapridæ*).

given a more thorough mastication before it passes into the third and fourth compartments of the stomach where the true digestive process begins. In all Ruminants the incisors or front teeth in the upper jaw are lacking.

Most of our domestic animals belong to families in this order; viz., the Horse and Ass are members of the family *Equidæ;* Swine of the *Suidæ;* and Oxen, Sheep and Goats belong to the family *Bovidæ*. All of these animals are descendants of wild ancestors, and the great number of so-called species or "breeds" of to-day are the result of artificial selection and domestication for many centuries.

Suborder ARTIODACTYLA. Deer, Oxen, Sheep, etc.

Family CERVIDÆ. Deer, Moose, Elk, Caribou, etc.

Antlers, when present, solid and branched in adult; upper canines usually present; at least the first molar in upper jaw brachydont; lateral hoofs present in all of our species, and with rare exceptions in all members of the family; lachrymal vacuity large, preventing articulation of the lachrymal bone with the nasal; lachrymal duct with two orifices. There are two subfamilies; *Cervinæ* and *Moschinæ*, but only the former is represented in America. In the various species belonging to this family, antlers, when present, seem to represent a secondary sexual character, as they occur as a rule in the male only.* The Caribou and Reindeer (*Rangifer*) are exceptions, however, both sexes usually having well developed antlers.

Of the thirty or more recognized species and races of *Cervidæ* which occur in North America, only five are represented within our limits, and of these only the Deer is found in any numbers at the present time. The Elk or Wapiti has long since disappeared; the Moose and Caribou, if they are to be found at all, are only of rare or accidental occurrence in extreme northern Wisconsin. All the males, and as has already been stated in the case of the Caribou the females as well, are provided with antlers, which are solid, branched and deciduous; that is to say, they are annually dropped and replaced by new and, up to a certain age, by larger ones, more branches appearing year by year. The antlers are usually dropped during March, but are soon replaced

* In practically all of our species the female occasionally has antlers, but such cases are rare.

by new ones which grow rapidly; at first they are soft, full of blood vessels, and provided with a fur-like outer covering known as "velvet." When full growth of the antler is attained, a ring of tubercles appears around the base, which is known as the "burr." This compresses the blood vessels and soon cuts off the supply of blood to the new antler, which quickly hardens and the "velvet" soon wears off.

KEY TO GENERA.

A. End of nose between nostrils almost, or entirely, covered with hair.
End of nose entirely covered with hair; antlers palmate (see cut below).
Genus RANGIFER, p. 80.

End of nose almost covered with hair (except a narrow slit of bare skin); antlers palmate (see cut below). Genus PARALCES, p. 74.

B. End of nose between nostrils entirely naked.
Antlers not palmate, most of tines or branches extending from front side of horn (see cut). Genus CERVUS, p. 67.

Antlers not palmate, most of tines or branches extending from back side of horn (see cut). Genus ODOCOILEUS, p. 60.

KEY TO THE SPECIES.

Skull less than 12 inches long; antlers (in male) less than 30 inches long, terminal half or more curved forward (in adult), tines extending from *back* side of antler; female without antlers; general body color, reddish brown or grayish brown.

VIRGINIA DEER. WHITE-TAILED DEER.
Odocoileus virginianus (Illinois), p. 60.
NORTHERN WHITE-TAILED DEER.
Odocoileus virginianus borealis (Wisconsin), p. 64.

Skull more than 15 inches long (average adult, 18 to 19.50); antlers (in adult) more than 36 inches long, bending backward and with tines or branches extending from *front* side of antler; antlers not decidedly flattened and palmate.

AMERICAN ELK. *Cervus canadensis*, p. 67.

Skull more than 15 inches long (average adult, 16 to 17½ inches); antlers large and irregular, most of the numerous branches being flattened and palmate; upper canines usually present; antlers in both sexes; end of nose covered with hair.

WOODLAND CARIBOU. *Rangifer caribou*, p. 81.

Skull more than 15 inches long (average adult, 22 to 23 inches); antlers heavy, broad, much flattened and largely in one piece, without long irregular branches; tines extending in simple points from the edge of the main part of the antler; upper canines absent; female without antlers; general body color, brownish black; end of nose covered with hair (except a narrow slit between nostrils). MOOSE.

Paralces americanus, p 74.

Subfamily CERVINÆ.

Genus **ODOCOILEUS** Rafin.

Odocoileus Rafinesque, Atlantic Journal, I, No. 3, 1832, p. 109. Type *Odocoileus speleus* Rafin. = *Cervus dama americanus* Erxleben.

Lateral hoofs developed but comparatively small; terminal half of antlers curved forward, the tines extending from back side of antler; antlers (normally) in male only; upper canines absent; exposed metatarsal gland on outer side of leg; lateral metacarpals complete.

*Dental formula:** I. $\frac{0-0}{3-3}$, C. $\frac{0-0}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3}=32$.

Odocoileus virginianus (BODD.).

VIRGINIA DEER. WHITE-TAILED DEER.

Cervus virginianus BODD., Elench. Animal, I, 1785, p. 136. ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 186 (Iowa).

Cervus Virginianus KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 580 (Cook Co., Illinois).

Cariacus virginianus GARMAN, Bull. Essex Inst., XXVI, 1894, p. 4 (Kentucky).

Odocoileus virginianus ALLEN, Amer. Nat., XXXIV, 1900, p. 318. HAHN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 456 (Indiana). *Ib.*, Ann. Rept. Dept. Geol. Nat. Resources Ind., 1908 (1909), p. 457 (Indiana).

Odontocœlus americanus ELLIOT, Field Mus. Pub., Zöol. Ser., VI, 1905, p. 43.

Odocoileus americanus WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 516 (Illinois).

Type locality — Virginia.

Distribution — Formerly middle United States, from north of Florida and the Gulf states to about latitude 43, and west to the plains; beyond these limits slightly different geographical races occur (see map). Now probably extinct in Illinois and in the more settled portions of its former range.

* Although having the appearance of an incisor, osteologists consider the fourth lateral incisoform tooth to be really a canine.

Virginia or White-tailed Deer (*Odocoileus virginianus*).

Description — Adult: Color of sexes similar; antlers of male as illustrated, rarely exceeding 29 inches in length and usually less; *in summer*, general color, reddish brown; belly, under surface and tip of tail, inner side of legs and a patch on the throat, white; a whitish band across the nose and a ring around each eye; a blackish spot on each side of the chin; upper surface of tail dusky; *in winter*, general color grayish or grayish brown. Female normally without horns.

Young: Reddish brown or bright bay, spotted with white; the spots gradually fade and disappear when the fawn is between 4 and 5 months old.

Measurements — Adult male: Length, about 60 to 68 inches; tail, about 10 inches (to end of hairs about 3 inches more); height at shoulder variable, about 36 inches.

Although formerly Deer were very abundant throughout Illinois, they are now practically exterminated in the state. It is claimed that a very few still linger in the extreme southern counties. Mr. B. T. Gault, in a letter to me, dated January 20, 1910, writes: "In the fall of 1900 there were several Deer in the hill country not far from Thebes, Alexander County (southern Illinois), but I have since been told that they have all been killed off." He later kindly sent me a letter from Mr. C. J. Boyd of Anna, Illinois, dated April 7, 1910, in which he writes: "There are a few Deer in the hills in this county and in Alexander County. It was reported that a doe and two fawns were seen close to the line of this county and Alexander County last summer" (1909). Butler states (Proc. Ind. Acad. Sci., 1895, p. 83) that a Deer was seen in Newton County,* Indiana, in 1891. Mr. E. J. Chansler of Bicknell, Knox County, Indiana, writes: "The last wild Deer was reported from near Red Cloud by the late N. B. Edwards in 1893." This seems to be the last record for that state.

In Wisconsin, where Deer are still abundant in the more northern counties, they are larger and are recognized as a distinct race (*O. v. borealis*), the difference, however, being mainly one of size.

In the southern states two other geographical races are recognized, the Louisiana Deer and the Florida Deer, the latter being decidedly smaller than the Virginia Deer, full grown bucks often weighing not over 110 pounds. These, however, are smaller than the average, and I have killed at least one specimen in southern Florida which weighed more than 200 pounds.†

Deer hunting is a favorite sport for many people, and I plead guilty of having killed a considerable number in my time; but as we grow older

* Newton County, Indiana, borders Illinois in the Kankakee region.

† For many years I carried steelyards with me in the field for the purpose of weighing large game. One buck weighed 204 lbs., and during a dozen years I have killed others which I did not weigh but which were fully as large.

the unnecessary killing of harmless animals becomes repugnant to us, and I am glad to say that during the last dozen years I have killed very few and only when meat was needed in camp. Deer are usually hunted in three ways (fire hunting not included, and being rarely indulged in by true sportsmen). (1) Hunting them with hounds, the hunter stationing himself on a runway. (2) To "slow trail" them, a method which is largely followed in southern countries. A hound is trained to follow a trail slowly and without barking. He must go slowly enough to enable the hunter to keep within a few yards of him. Sooner or later the Deer is "jumped," usually within shooting distance. (3) The method known as still hunting. To be a successful "still hunter" requires keen eyesight combined with a knowledge of wood craft and the habits and ways of Deer, which few white men possess.

In a comparatively open country, where Deer have not been much hunted, one may often approach within a shooting distance by keeping to leeward of the animal and creeping forward while it has its head down feeding, and remaining motionless when it lifts its head, which it does every few minutes. For some reason a Deer usually shakes his tail before lifting his head. By bearing this in mind, on one occasion I approached within 100 yards of a buck feeding in an open prairie where the grass was not over 12 inches high. Once the Deer raised his head and looked directly at me before I had time to lie down in the grass. I remained perfectly still and after gazing at me for a moment he stamped once or twice, advanced a few steps and stamped again; but after examining me for some time he apparently came to the conclusion that I was a part of the scenery, or at least some strange animal which was not dangerous, whereupon he commenced to feed again. Of course this was due to the fact that the wind was blowing from the Deer towards me; had it been the other way, the sense of smell is so acute in these animals that such a near approach would have been impossible. When frightened a Deer will usually utter a startled snort, which is almost invariably given preliminary to flight. When running a Deer usually holds its tail straight up in the air, at least for a short distance, the white under surface showing clearly as it bounds high over the bushes. If it goes off with its tail down, it is a pretty sure indication that it is badly wounded.

The antlers of the Virginia Deer are usually dropped in March. The rutting season begins during the latter part of October and usually lasts until late in November and the majority of the young are born in May. For the first few days, until the fawn is strong enough to follow her about, the mother leaves it in some concealed spot while she seeks her food, returning from time to time to learn of its welfare and to suckle it. I have on several occasions found very young fawns in the woods and they always lay perfectly still and permitted themselves to be handled;

but upon leaving them and returning to the spot a short time afterwards, they had invariably disappeared. The food of the adult consists largely of grass and the young and tender leaves and buds of shrubs and trees, together with aquatic plants.

Albinism occurs occasionally in Deer as in many other mammals, although perfectly white specimens are rare. The Field Museum collection contains a fine white buck of the northern race taken in Minnesota.

Odocoileus virginianus borealis (MILLER).

NORTHERN WHITE-TAILED DEER.

Odocoileus americanus borealis MILLER, Bull. N. Y. State Mus., VIII, 1900, p. 83. JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 4 (Wisconsin); *Ib.*, VIII, 1910, p. 86 (Wisconsin).

Odocoileus virginianus borealis ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 128 (Michigan).

Odocoileus virginianus SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 126 (Wisconsin).

Cervus (Cariacus) virginianus HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 281 (Minnesota).

Cervus Virginianus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 337 (Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin).

Cervus virginianus MILES, Geol. Surv. Mich., 1861, p. 222 (Michigan).

Type locality — Bucksport, Maine.

Distribution — Northern tier of United States and southern Canada, west at least to the Rocky Mountains.

Special characters — Similar to *O. virginianus* but larger, and the general color paler, or grayer.

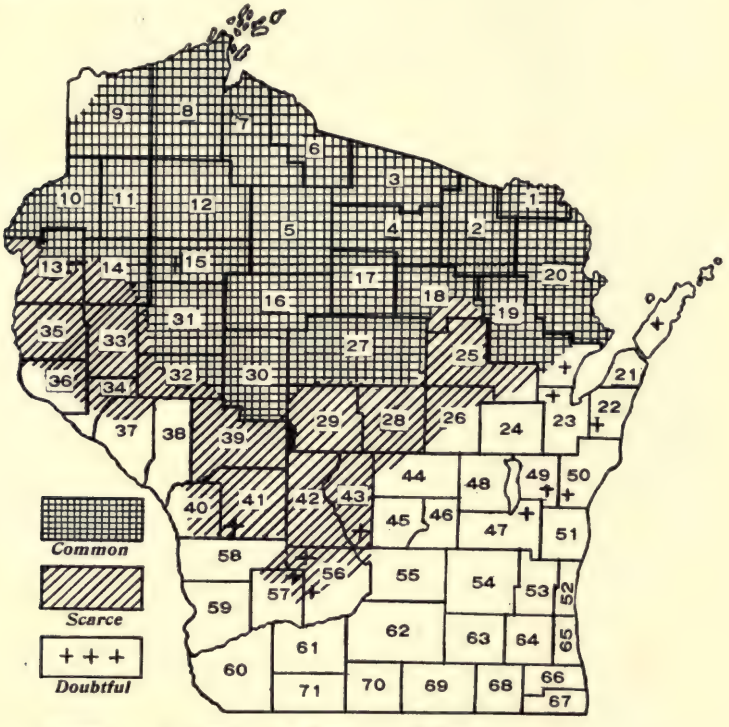
The Northern White-tailed Deer is merely a large and somewhat grayer race of the Virginia Deer. All Deer which occur in Wisconsin at the present time probably belong to this form. The average weight of a full grown buck may be estimated at from 200 to 225 lbs., although Deer weighing 300 lbs. are by no means uncommon, and Mr. E. T. Seton records one having the unusual weight of 400 lbs.*

In northern Wisconsin Deer are abundant in many localities and large numbers are killed every season. Mr. W. L. Kinney of Eagle River, Vilas County, informs me that in November, 1906, 300 dead Deer were shipped from that station. Farther south they become less common, and in Jackson, Munroe, and Juneau counties they are comparatively scarce. Probably the most southern limit of their range in Wisconsin at the present time is Sauk County, where, according to Mr. H. B. Quimby of Reedsburg, they are still to be found. Jackson states that lately Deer have become quite abundant in Sauk County, (*l. c.*, p. 86).

* Life Histories of Northern Animals, I, 1909, p. 71.

In the extreme southern portion of the state and in the more thickly settled districts they have long since been exterminated. Mr. N. Hollister states* that Deer were abundant in Walworth County up to about 1842, but that none was seen in that locality later than 1852.

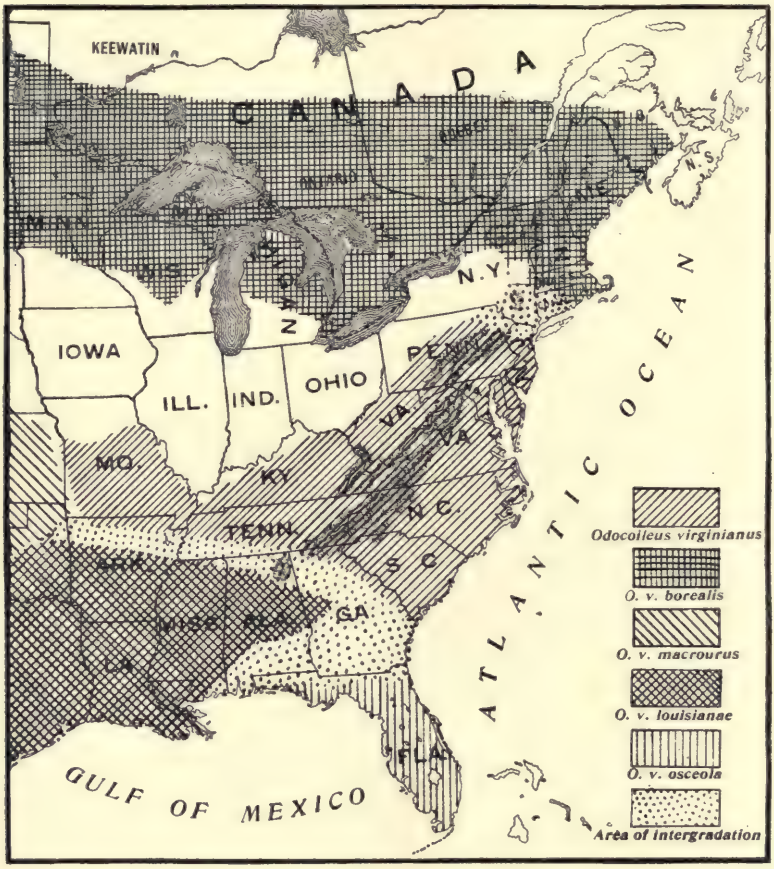
Specimens examined from Illinois, Wisconsin and adjoining states: Wisconsin — Florence Co., 16; (O.) Iron Co., 9; Vilas Co., 6=31. Minnesota — 1 (albino).



1. Florence.	18. Langlade.	36 Pierce.	54. Dodge.
2. Forest.	19. Oconto.	37 Buffalo.	55. Columbia.
3. Vilas.	20. Marinette.	38. Trempealeau	56. Sauk.
4. Oneida.	21. Door.	39. Jackson.	57 Richland.
5. Price.	22. Kewaunee.	40. La Crosse.	58. Vernon.
6. Iron.	23. Brown.	41. Monroe.	59. Crawford
7. Ashland.	24. Outagamie.	42. Juneau.	60. Grant.
(inc. Apostle Isls.)	25. Shawano.	43. Adams.	61. Iowa.
8. Bayfield.	26. Waupaca.	44. Waushara.	62. Dane.
9. Douglas.	27. Marathon.	45. Marquette	63. Jefferson.
10. Burnett.	28. Portage.	46. Green Lake.	64. Waukesha.
11. Washburn.	29. Wood.	47. Fond du Lac	65. Milwaukee.
12. Sawyer.	30. Clark	48. Winnebago.	66. Racine.
13. Polk.	31. Chippewa.	49. Calumet.	67. Kenosha.
14. Barron.	32. Eau Claire	50. Manitowoc.	68. Walworth.
15. Rusk or Gates.	33. Dunn.	51. Sheboygan.	69. Rock.
16. Taylor.	34. Pepin.	52. Ozaukee.	70. Green.
17. Lincoln.	35. St. Croix.	53. Washington.	71. Lafayette.

Map illustrating approximate present range of the Northern White-tailed Deer, *O. v. borealis*, in Wisconsin.
Prepared with the kind coöperation of 63 residents in the different counties.

* Bull. Wis. Nat. Hist. Soc., VI, 1908, 142.



Map illustrating approximate distribution of races of the Virginia or White-tailed Deer in eastern North America. The central white area indicates the portion of its former range where it is now practically extinct.

Odocoileus virginianus (BODD.). Type locality — Virginia. Description as previously given.

Odocoileus v. borealis (MILLER). Type locality — Bucksport, Maine. Range and description as previously given.

Odocoileus v. macrourus (RAFIN.). (Amer. Month. Mag., I, 1817, p. 436.) Type locality — Plains of Kansas River. General color, paler.

Odocoileus v. louisianæ G. ALLEN. (Amer. Nat., XXXV, 1901, p. 449.) Type locality — Mer Rouge, Morehouse Parish, Louisiana.
Size of *virginianus;* color in winter, pale; skull, long and slender.

Odocoileus osceola (BANGS). (Proc. Biol. Soc. Wash., X, 1896, p. 26.) Type locality — Citronelle, Citrus Co., Florida.
Decidedly smaller than *louisianæ*, the color darker and horns smaller.

Genus **CERVUS** Linn.

Cervus Linnæus, Syst. Nat., X ed., I, 1758, p. 66. Type *Cervus elaphus* Linn.

Size, large; upper canines usually present; antlers, large, turned backward with the tines extending forward; basal tines present and extending over forehead; antlers normally in male only; lateral metacarpals incomplete.

Dental formula: I. $\frac{0-0}{4-4}$, C. $\frac{1-1}{0-0}$ or $\frac{0-0}{0-0}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3}$ = 32 or 34.

Cervus canadensis (ERXLEBEN).

AMERICAN ELK. WAPITI.

[*Cervus elaphus*] *canadensis* ERXLEBEN, Syst. Regni Anim., I, 1777, p. 305.

Elaphus Canadensis LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340. KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 580 (Cook Co., Illinois).

Elaphus canadensis DE KAY, Zoölogy of New York, Pt. I, Mammalia, 1842, p. 119. AUDUBON & BACHMAN, Quadrupeds of N. Amer., II, 1851, p. 83.

Cervus canadensis MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 222 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 184 (Iowa). CATON, Antelope and Deer of America, 1877, p. 80 (Illinois). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 42 (Iowa). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 278 (Minnesota). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 4 (Kentucky). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 180 (Tennessee). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 15 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 137 (Wisconsin). HAHN, Ann. Rept. Dep. Geol. & Nat. Resources Ind., 1908 (1909), p. 454 (Indiana). F. E. WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 515 (Illinois). N. A. WOOD, Mich. Geol. & Biol. Surv. Pub., IV, 1911, p. 309 (Michigan).

Cervus Canadensis THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 651 (Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). HOY, Trans. Wis. Acad. Sci. Arts & Letters, V, 1882, p. 256 (Wisconsin).

Type locality — Eastern Canada.

Distribution — Formerly throughout the greater portion of middle and northern United States, and in eastern Canada north to about the latitude of Montreal; further west its Canadian range extended gradually further north, until in Alberta it reached at least to latitude 56°. At the present time it is found in a wild state practically only in the Rocky Mountain region* from Colorado to Alberta. A slightly different subspecies, *C. c. occidentalis*, occurs in Washington, Oregon, and British Columbia, and closely allied species are found in California (*C. nannoides*) and in the mountains of Arizona and New Mexico (*C. merriami*).

* It is claimed that a few of these animals still exist in northern Minnesota.

American Elk (*Cervus canadensis*).

Description — Adult male: Legs very large, much larger than a Virginia Deer; antlers usually more than 40 inches long, turned backward and tines or branches extending from front side of antler; general body color pale tawny brown; head, neck and chest dark brown; legs clove brown; a noticeably large yellowish white patch on rump, surrounding the tail; young with white spots.

Measurements — Adults: Length, about 7½ to 8 feet; height at shoulder, 4½ to 5¼ feet; average weight, 500 to 600 lbs.

For many years the Elk has been extinct in Illinois and Wisconsin. Only a few antlers, which are occasionally found, remain to mark the presence within our limits of this noble representative of the Deer family which was at one time so abundant.

Elk antlers may readily be distinguished from those of our Deer by the following characters:

Elk antlers (adult) — Size large, more than 35 inches long, turned backward, with tines or branches extending from front side of antler; basal tines present and extending over forehead.

Deer antlers (adult) — Size medium, less than 30 inches long, terminal half curved forward, the tines or branches extending from back side of the antler.

American Elk.

Virginia Deer.

In the early part of the last century Elk or Wapiti* were common as far east as Virginia and New York, but the march of civilization drove them further and further west with constantly decreasing numbers. Audubon states that there were still a few left in the mountains of northwestern Pennsylvania as late as 1835, and they were known to exist in western Virginia in 1847. They disappeared in New York at even an earlier date, the latest record being given by Dr. De Kay, who

* Barton states that *Wapiti* is the name by which this animal was known to the Shawnee Indians (Phila. Med. & Phys. Journ., March, 1806, p. 37).

states that Elk were killed on the north branch of the Saranac in New York State as late as 1836 (*l.c.*, p. 119).

Nearly all of the early travelers in Illinois refer to the abundance of large game including Elk. André Michaux, writing of the country in the vicinity of Kaskaskia, Randolph County, Illinois (1793–96), says, "My guide killed an Elk called Cerf by the Canadians and French of Illinois. This animal is much larger than the dwarf Deer of the United States of which there is an abundance also in the Illinois Country and which the French of those countries call Chevreuil. Its antlers are twice the size of those of the European Stags."* Woods (1822) states, "To the north of us [English Prairie, Illinois] there are buffaloes and elks, also beavers and others on the rivers."† Caton writes, "The last account I get of their presence in northern Illinois was in the year 1820 or thereabouts. In 1818 they were not observed east of the Illinois River and but few were then found on the western bank of that stream. An old settler of high respectability assures me that he saw their tracks in the forest north of Peoria in 1829 but did not see the animals." (*l.c.*, p. 80) Kennicott in his "Animals observed in Cook County, Illinois," says, " Several elks have been shot in the county." (*l.c.*, p. 580)

In southern Illinois they are claimed to have been common about 1820. Mr. E. J. Chansler of Bicknell, Knox County, Indiana, writes: "The last wild Elk killed in Knox County in Indiana, so far as I know was killed by George Yeverbough in 1829, near Pond Creek. Mr. Ammon Stafford saw the Elk and told me about it. Mr. Bradway Thompson told me that he saw an Elk near Bruceville, this county, in 1830. These dates are reliable and so far as I know are the last records for the state, although Mr. I. N. Gilmore says he saw an Elk in 1850. This was perhaps a stray tame Elk."

In Wisconsin it was apparently found much later. Dr. Hoy writes (1882), "Elk, *Cervus Canadensis*, were on Hay River in 1863 and I have but little doubt that a few still linger with us. The next to follow the buffalo, antelope and reindeer" (*l.c.*, p. 256). Strong says (1883), "Occurs very rarely in northern and central Wisconsin. It was formerly quite numerous, but is now almost extinct" (*l.c.*, p. 437). Brayton states on the authority of B. H. Van Vleck that in 1882 Elk were still found in the vicinity of Green Bay, Wisconsin.‡

In Michigan, according to Miles, Elk were numerous in the eastern part of the state as late as 1860. He says: "The Elk is found in abun-

* Michaux, André. Travels into Kentucky, 1795–1796. (Translation in Thwaites's Early Western Travels, III, 1904, p. 73.)

† Woods, J. Two Years' Residence in the Settlement on English Prairie in the Illinois Country, 1820–1821 (1822), p. 194.

‡ Rept. Geol. Surv. Ohio, IV, Pt. 1, Zoöl., 1882, p. 80.

dance in the counties of Huron and Sanilac about the head waters of the Cass River. The unrelenting pursuit of hunters by means of the rifle and trap pens will soon exterminate it, unless means are taken to prevent an indiscriminate slaughter at all seasons of the year" (*l.c.*, p. 222, foot note). Wood says "Mr. Fittenger informed us that in 1856 the Elk was not uncommonly found on Sand Point (Saginaw Bay) and that he shot a specimen on the shore of Mud Lake (at the base of the Point) in September of that year" (*l.c.*, p. 309).

In Minnesota Elk were at one time very numerous and it is claimed that a few individuals still exist in the extreme northern part of the state. Herrick states that as late as 1885 the Indians occasionally succeeded in killing one in the region north of Lake Superior, and he was informed that in that year they were found about Red Lake (*l.c.*, p. 280).

Even at the present time Elk antlers are occasionally found within our limits, usually in ponds or buried in marshy ground. I am informed that some years ago a good pair was found in Fox Lake, Illinois, and Mr. Paul Hohnheiser of Wausau, Wisconsin, writes me he has a large pair of Elk antlers found in a lake in that vicinity, which measures 45 inches in length. Mr. Jacob Bream of Cream, Buffalo County, Wisconsin, writes me that in 1870 he found a pair of Elk antlers with the skull, in Township 22, Range 11, West. The spread of the antlers was about 4 feet. Jackson states he has examined antlers found in Ashland and Iron counties, Wisconsin (*l.c.*, p. 15). Hollister says: "Sections of antlers are still occasionally found in Walworth County, most frequently under marshy ground. A fine pair was taken from Delavan Lake some years ago" (*l.c.*, p. 137). Mr. H. L. Ward records a pair of antlers in the Milwaukee Public Museum, which was found by Mr. Frank Clark in Pewaukee, in 1899.*

Elk are gregarious animals, being found in large herds, especially in winter. In summer the herds are much smaller, the animals being scattered in wandering bands over a much larger territory. They prefer a forested country, and in a mountainous region during the warm season they frequent the higher ranges where spruce and pine abound; but at the approach of cold weather, when the snow begins to get deep, they descend to lower levels and pass the winter in the valleys and foothills. They are promiscuous vegetable feeders when hungry, but they much prefer the leaves and buds of deciduous trees and shrubs. Elk are polygamous and during the rutting season in September and early October the bulls fight savagely for the possession of the females. In these combats they use their antlers,† sometimes with serious results;

* Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 146.

† In attacking a dog an Elk will very often attempt to strike him with his feet.

but generally the vanquished is but slightly injured and goes away in search of other cows which by chance may be husbandless or at least are guarded by a bull less powerful than himself.

One old and lusty bull will appropriate for his harem as many cows as he can get and will attack and drive away any presumptuous young bull which has the temerity to approach them. If, however, the battle results disastrously to the reigning lord of the herd, his conqueror will immediately take charge of the family of cows, who accept him as a matter of course. During the rutting season (and occasionally at other times) the bulls utter their "bugle" cry. It begins with a low roaring sound, rising to a shrill, screaming, double-toned whistle and ends with a series of loud grunts. The cry of the cow is penetrating and high, and may be crudely described as a squeal.

The majority of the young are born late in May or early in June but occasionally much later. On two occasions I have found newly born young in August. The number at a birth is usually one, sometimes two, and according to some authorities, rarely three. For a few days after birth, or until it has become quite strong and active, the little Elk calf is left concealed under bushes or high grass by the mother, who returns to it from time to time to suckle and care for it. On several occasions I have found young Elk thus hidden, which were certainly not more than a day or two old. Those which I have found would remain perfectly quiet and permit themselves to be stroked, but if lifted from the ground would usually struggle and "bleat" loudly. Young animals are spotted with white, but the spots fade and disappear when they are about 12 weeks old.

The size of the antlers and number of points vary more or less in different animals of the same age. One bull born in my Park*, when 8 years old, had a fine pair of antlers having 14 points, while another 9 years old had but 13. According to my notes the annual increase in size and number of points of the antlers of the latter bull were as follows: Summer of birth, 0; 2nd year, spikes (not branched); 3rd year, 4 points on each antler = 8; 4th year, like 3rd year but a small extra point on left antler, 9 points in all; 5th year, 6 points on each antler = 12; 6th year, no record, one horn having been broken; 7th year, 12 points, 6 on each antler; 8th year, 7 points on one antler and 6 on the other; 9th year, the same number of points, but horns somewhat larger and heavier and

* For many years the writer had a small herd of Elk on his country estate at Great Island near Hyannis, Massachusetts. The animals lived in a semiferal state, being confined in a wooded park having an area of about 175 acres. In 1901 the herd numbered 12 animals, including 3 bulls, 7 cows, and 2 calves, having increased from 2 bulls and 4 cows in 1890. In addition to those living in 1901, 4 bulls, 2 cows, and several calves had died or been killed (2 dead calves were found but there is no doubt there were others).

upper tines differing more or less in shape from those of previous year. This animal was then killed, as he had become very ugly and bold.

Antlers measuring from 50 to 55 inches may be considered the average length of a good pair of an old bull, but up to 58 inches is not unusual. The largest known Elk antlers are those recorded by Mr. Seton, measuring 64 and 66 inches long.*

The name Elk is used for the European cousin of our Moose which, it is needless to say, is a very different animal from our "Elk." The common use of the name for both species is sometimes confusing, but there appears to be little chance of a new name being accepted for either.

Map illustrating the supposed former and the present range of the American Elk or Wapit (*Cervus canadensis*) in eastern North America. The species probably no longer exists in a wild state east of Minnesota, and in the localities where it is still to be found in the West its numbers are rapidly decreasing. In western Canada its former range extended northward at least to latitude 56°. Other slightly different species occur on the Pacific Coast and in Arizona.

In 1909 Mr. Ernest Thompson Seton estimated the number of living Elk in North America to be about 45,650, distributed as follows: Yellowstone Park, 20,000; Wyoming (outside the Park), 5,000; Manatoba, 5,000; Idaho, 5,000; Montana, 4,000; Vancouver Island, 2,000; Washington, 1,500; Alberta, 1,000; Saskatchewan, 500; Oregon, 200; California, 200; British Columbia, 200; Minnesota, 50; in various zoos, parks, etc., 1,000. (Life Histories of Northern Animals, I, 1909, p. 48.)

This map is largely copied from that given by Mr. E. T. Seton in his Life Histories of Northern Animals, with some slight changes based upon records and notes of the author.

* Life Histories of Northern Animals, I, 1909, p. 58.

The Indian name, Wapiti, for our Elk (*Cervus canadensis*), would be distinctive, but there is little likelihood that it will ever be popularly used.

Many statements by ancient writers concerning animal biography are amusing, being undoubtedly derived from current popular traditions and tales of hunters and travelers. In their accounts of various species much space is usually devoted to describing the supposed medicinal or curative powers of different parts of the animals. In this connection we are informed that the hoofs of members of the Deer family are of value in the treatment of epilepsy, the left hind foot being especially recommended. Birt says: "Ancient authors relate that the Northern People catch the Elk by watching the Opportunity when it falls down of the Epilepsy, and laying hold of it before it recovers Strength enough to put its left hind Foot in its left Ear, which cures it immediately; and it is that particular Hoof, forsooth, which is the applauded Remedy for the Falling Sickness." (Wonders of Nature and Art, II, 1750, p. 114.)

Genus **PARALCES** Allen.

Paralces Allen, Bull. Amer. Mus. Nat. Hist., XVI, 1902, p. 160. Type *Cervus alces* Linn.

Size large; antlers broadly palmate; no metatarsal gland; tarsal gland small; tail short; muzzle long, broad and overhanging; end of nose covered with hair except a small triangular bare space between lower portion of nostrils; a pendulous growth of skin and long hair on the throat; main hoofs long and pointed; lateral hoofs comparatively well developed.

Dental formula: I $\frac{0-0}{4-4}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3} = 32$.

Paralces americanus (CLINTON).

MOOSE.

Cervus americanus CLINTON,* Letters on Nat. Hist. & Int. Resources of N. Y., 1822, p. 193.

Alces americanus JARDIN, in Nat. Library, XXI, 1835, p. 125. MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 222 (Michigan). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 270 (Minnesota).

Cervus alces LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin).

Alce Americanus HOY, Trans. Wis. Acad. Sci. Arts & Letters, V, 1882, p. 256 (Wisconsin).

Alce americanus HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 138 (Wisconsin).

* See Osgood, Proc. Biol. Soc. Wash., XV, 1902, p. 87

Moose (Alce) ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 131 (Michigan).

Type locality — North America.

Distribution — British America and in Maine, Minnesota, and the Rocky Mountains from Wyoming northward; casual or accidental elsewhere in extreme northern United States, formerly considerably further south;* replaced in Alaska by another and larger species.

Description — Adult male in winter: Antlers very large and broadly palmate; general color of hair blackish or blackish brown; under parts blackish brown, except lower belly, which is pale brownish gray; inside and entire lower portion of legs brownish gray; more or less gray on muzzle; tail very short, black, tipped with a few gray hairs; dewlap† (a pendulous "bell" hanging from the neck) black; end of nose between nostrils almost entirely covered with hair except a very narrow triangular bare space.

Adult female: Similar but smaller and without antlers; "bell" present but small.

In summer: Rather lighter in color and legs tawny gray. The young is reddish brown without spots.

Measurements — Length, 8½ to 9 feet; tail 2½ inches; height at shoulder, 5½ to 6½ feet; average spread of antlers in adult, 52 to 58 inches; length of antlers, 40 to 45 inches.

Moose were abundant in Wisconsin up to the middle of the last century, and more or less common in a few localities at a much later date. It is not unlikely that even at the present time one or two individuals may still be found in the extreme northwestern part of the state.

In 1881 Dr. Hoy writes, "Moose, *Alce Americanus*, continue to

* There is little doubt that in the early part of the 18th century the range of the Moose extended in New England at least so far south as Massachusetts and possibly northern Pennsylvania. Catesby estimates the southern limit of its range to have been about latitude 40°, but his opinion was based upon hearsay evidence and is of little value (Nat. Hist. Carolina, II, 1743, p. xxvii). Several ancient writers state that Moose were common in New England, but with few exceptions they are not specific as to localities. Paul Dudley, however, says, "A few years since a Gentleman surprised one of these black Moose in his Grounds within two miles of Boston; it proved a Doe or Hind of the fourth year; after she was dead, they measured her upon the Ground, from the Nose to the Tail, between ten and eleven Feet, She wanted an Inch of seven Foot in height." (Phil. Trans., XXXI, No. 386, 1721, p. 166.) Wm. Wood also informs us that "There be not many of these in Massachusetts Bay, but forty miles to the northeast there be great store of them" (New England's Prospect, 1634). It is claimed that Moose antlers were found in a salt lick in northern Pennsylvania in the Alleghany Mountains near the New York state line (Doughty's Cabinet Nat. Hist. I, 1830, p. 281).

† The bell varies in length but is usually from 8 to 12 inches. Mr. E. T. Seton records a freak specimen having a bell 38 inches long (Life Hist. of Northern Animals, I, 1909, p. 163).

Moose (*Paralces americanus*).

inhabit the northern part of the state, where they still range in spite of persecution. A fine cow moose was shot near the line of the Wisconsin Central Railway in December, 1877" (*l. c.*, p. 256). Strong says, "Found very rarely in hardwood timber in northern Wisconsin. It is rapidly becoming extinct in the state" (*l. c.*, p. 437). In a letter dated January 2, 1910, Mr. N. Lucins, Jr., of Solon Springs, Douglas County, writes, "Three Moose were killed in this county in 1886 and one in 1900, and there are four or five in this county now." Mr. J. M. Sayler, also of Solon Springs, writes, "Three Moose were killed in 1886 in Brulee and one about 1900 on the St. Croix." These were, without doubt, the same Moose referred to by Mr. Lucins. Mr. George W. Zeon of Foxboro, Douglas County, writes, "Moose have been killed in Douglas County, but not for 5 years." Some years ago I was told by an old hunter, whose name I have unfortunately forgotten, that in 1885 a few Moose were to be found in Burnett, Douglas and Bayfield counties; this statement is supported as regards the latter by Mr. M. Berg of Cable, who writes, "There was a Moose killed here about 25 years ago." Mr. W. J. Webster, Superintendent of Schools, Park Falls, Wisconsin, writes me that he heard of Moose having been killed in Price County some years ago. Mr. Dan Farnham of Manley, Douglas County, writes me that a Moose was killed at a place called Charlie Brook in the fall of 1909. Mr. John Chaffey of Chaffey, Douglas County, writes, "Several Moose have been killed in Douglas County. About two years ago (1907) one was killed in Township 45, Range 15, that *is* a Moose."

Mr. Edward E. Kingsford of Iron Mountain, Michigan, writes, "I have never known of but one Moose in this part of the country. That was in the fall of 1882 in what is now the northern part of Dickinson County. We saw his tracks very frequently during the winter along with Deer. A few years later a Moose was killed near Floodwood on the line of the Milwaukee & Northern Railroad, then being built. Moose were plenty 20 years ago in northern Minnesota, and I think it was in the fall of 1897 that a Moose came into the city of Duluth and, after taking in some of the principal streets, went back to the woods unmolested."

The Moose, which is the largest representative of the Deer Family, is a huge animal, an adult bull often weighing twelve or thirteen hundred pounds, and occasionally more. It is very shy and its sense of hearing is extremely acute, rendering it a difficult animal to "still-hunt," as it is called. It has been claimed that no one but an Indian is able to do this successfully. This is not strictly true, but it must be admitted that very few white hunters are as capable. A favorite

method of the Indian and white hunters of the North is known as "Moose calling", and consists of imitating the call of the cow Moose during the rutting season. This may be crudely described as a prolonged Eeooo-yah, lasting four or five seconds. A cone, usually made of birch bark, is used, resembling a small megaphone. The answer of the male is a short, loud grunt, sometimes several in quick succession. While the bull will come from a considerable distance to the call of what he considers to be a female of his species, his sense of hearing and of smell is so acute that the slightest indiscretion on the part of the hunter will send him crashing away through the bushes, and the hope of killing that particular bull may be abandoned. In localities where these animals are much hunted they are exceedingly wary and difficult to approach.

Captain Butler, writing of the Moose in the Peace River region, says, "To hunt the moose requires years of study. Here is the little game which his instinct teaches him. When the early morning has come, he begins to think of lying down for the day. He has been feeding on the gray and golden willow tops as he walked leisurely along. His track is marked in the snow or soft clay; he carefully retraces his footsteps, and breaking off suddenly to the leeward side, lies down a gun shot from his feeding track. He knows he must get the wind of any one following his trail.

"In the morning Twa-poos, or the Three Thumbs, sets forth to look for a moose. He hits the trail and follows it; every now and again he examines the broken willow tops or the hoof marks. When experience tells him that the moose has been feeding here during the early night, Twa-poos quits the trail, bending away in a deep circle to leeward; stealthily he returns to the trail, and as stealthily bends away again from it. He makes as it were the semicircles of the letter B, supposing the perpendicular line to indicate the trail of the moose. At each return to it he examines attentively the willows, and judges his proximity to the game. At last he is so near that he knows to an absolute certainty that the moose is lying in a thicket a little distance ahead. Now comes the moment of caution. He divests himself of every article of clothing that might cause the slightest noise in the forest, even his moccasins are laid aside, and then, on a pointed toe which a ballet-girl might envy, he goes forward for the last stalk. Every bush is now scrutinized; every thicket examined. See he stops all at once! You who follow him look, and look in vain; you can see nothing. He laughs to himself, and points to yon willow covert. No, there is nothing there. He noiselessly cocks his gun. You look again and again, but you see nothing. Then Twa-poos stretches out

A record Head. Alaskan Moose. Collection of Field Museum of Natural History.

his hand and breaks a little dry twig from an overhanging branch. In an instant right in front, thirty or forty yards away, an immense dark-haired animal rises up from the willows. He gives one look in your direction and that look is his last. Twa-poos has fired, and the moose is either dead in his thicket or within a hundred yards of it."

The so-called Moose yards, made in the deep snow in winter, are simply irregular spaces and pathways trampled down by the animals while seeking their food or resting in some favorable locality. In the summer season their food consists of leaves and young twigs and buds, and occasionally grass when they are hungry. They frequent ponds and rivers, especially during the mosquito season, and are very fond of aquatic plants, preferably lily pads.

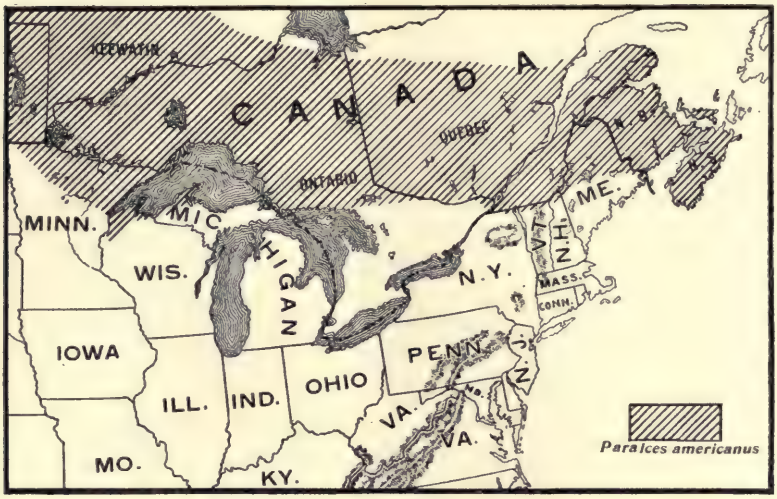
A full grown bull of this species will stand over 6 feet high at the shoulders and the massive horns will spread from 60 to 65 inches (67 has been recorded). One killed by William L. Roberts of Springfield, Massachusetts, measured 6 feet 10 inches in height;* another killed by Carl Rungius in New Brunswick is stated to have measured 7 feet at the withers,† and a very large animal killed by Dr. Hamilton Vreeland near Mattawa, Quebec, is claimed to have stood 7 feet 4 inches high at the withers.‡

These animals must be considered unusually large representatives

* Forest & Stream, Nov., 1899, p. 426.

† Hornaday, Wm. Amer. Nat. Hist., 1904, p. 140.

‡ Recreation Mag., Feb., 1896, p. 65.



Map showing supposed range of the Moose (*Paralces americanus*) in eastern North America. In early days its range extended further south.

of our eastern species, but the Alaskan Moose is the giant of its kind, specimens having been killed having a height of 7 feet 8 inches at the shoulders and with antlers spreading 75 inches or more. The largest known pair of antlers of an Alaskan Moose is preserved in the Field Museum collection. They measure 78½ inches in spread (it is claimed that when fresh they measured 84½ inches) and weigh 93¼ pounds.

Moose when not too old are readily broken to harness and are natural trotters and easily managed. Some years ago I had the pleasure of riding behind one on several occasions.

Genus **RANGIFER** Smith.

Rangifer H. Smith, Griffith's Cuvier Animal Kingd., V, 1827, p. 304. Type *Cervus tarandus* Linn.

Antlers present in both sexes; muzzle entirely covered with hair; hair on throat long, like a mane; main hoofs rather slender and deeply cleft; lateral hoofs elevated but well developed; upper canines often present; antlers large and irregular, most of the numerous branches being flattened and palmate; metatarsal gland absent; tarsal gland present; young unspotted or with a few pale spots faintly indicated which disappear at an early age. Species belonging to this genus are known as "Reindeer" in Europe.

Dental formula: I. $\frac{0-0}{4-4}$, C. $\frac{1-1}{0-0}$ or $\frac{0-0}{0-0}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3}$ = 34 or 32.

Rangifer caribou (GMEL.).

WOODLAND CARIBOU.

[*Cervus tarandus*] *caribou* GMELIN, Syst. Nat., I, 1788, p. 177.

Rangifer caribou AUDUBON & BACHMAN, Quadrupeds N. Amer., III, 1854, p. 111. BAIRD, Mammals N. Amer., 1857, p. 633 (Isle Royale, Michigan). MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 222 (Michigan). GILLMAN, Amer. Nat., VII, 1873, p. 751 (Isle Royale, Michigan). MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 40 (North shore Lake Superior). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 131 (Michigan). *Ib.*, 1908 (1909), p. 390 (Isle Royale, Michigan).

Rangifer tarandus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 274 (Minnesota).

Rangifer Caribou HOY, Trans. Wis. Acad. Sci. Arts & Letters, V, 1882, p. 256 (Wisconsin).

Type locality — Eastern Canada.

Distribution — Wooded portions of British America and northern portions of Maine, Montana and Minnesota; formerly casual or accidental in extreme northern Michigan and Wisconsin.

Description — Adult male in summer: Antlers large, irregular and variable, the branches much flattened and palmate; nose entirely covered with hair; hair on throat long; general color dark brown, much paler on the neck; lower part of abdomen, inside of legs and a space above the hoofs white.

In winter: General color decidedly more gray and head and neck grayish white. Female has antlers like the male but smaller.

Measurements — Adult male: Length, 6 to 6½ feet; height at shoulder, 42 to 48 inches; length of antlers, generally from 32 to 42 inches.

There is no reason to doubt the occurrence of the Woodland Caribou in early days in northern Wisconsin, but at the present time, if it occurs at all, it must be considered as an exceedingly rare straggler.

Dr. Hoy states: "The Woodland Caribou, *Rangifer Caribou*, were probably never numerous within the limits of the state, a few, however, were seen near La Point in 1840, none since" (*l.c.*, p. 256). In a letter to me under date of January 13, 1910, Mr. W. J. Webster, Superintendent of Schools, Park Falls, Price County, Wisconsin, writes, "A Caribou was killed in this county near White River, sometimes called Wide River, by a homesteader whose name I have forgotten. I think that the place was somewhere about ten miles southeast of Ashland."

Mr. R. E. Boll of Channing, Dickinson County, Michigan (about 18 miles from the Wisconsin state line), writes, "A cow Caribou was

Woodland Caribou (*Rangifer caribou*).

killed near Ralph, Michigan, in November, 1905, about 18 miles from here." Mr. E. G. Kingsford of Iron Mountain, Michigan, writes, "I have a fine pair of horns of a Caribou that was killed near Lake Vermillion, St. Louis County, Minnesota, in 1897, or about that time, so I think there is no reason why it should not have been found in the northwestern part of Wisconsin."

Miles includes it in his list of Michigan mammals and there is no question that in early days the species was not uncommon on Isle Royale. Baird and Gillman record it from there and the former figures a pair of antlers found on the Island (*l.c.*, p. 634). It is probable that it still occurs more or less regularly on Isle Royale, as Adams reports four Caribou having been seen by trappers in that locality on March 27, 1904; and on April 16, 1905, nine were seen on the ice near Rock Harbor (*l.c.*, p. 396). These animals had undoubtedly crossed on the ice from the main land, as the species is not uncommon in parts of northern Minnesota and along the north shore of Lake Superior.*

The Woodland Caribou is naturally a forest dweller frequenting the vicinity of water. During the greater part of the year it is usually found in small bands, and even during the semiannual migrations in spring and fall, when most of these animals move north or south, they do not congregate in such great herds as do their northern congeners. It has been claimed by several writers that more than a dozen or fifteen of these animals are rarely found together. This is probably true in many localities where Caribou are comparatively scarce; but the statement can hardly be considered accurate, if applied to the species as a whole. Macfarlane says, "Herds of the woodland species seldom exceed thirty or forty individuals, except in the autumn, when sometimes a large number congregate together";† and I have been told by old hunters that in the vicinity of English River (north of Lake Superior) in early days herds of fifty or more were not uncommon.

The food of the Woodland Caribou largely consists of "Caribou moss" (*Cladonia*) and other lichens, in addition to which, in the summer season, they eat aquatic plants and leaves and buds of various kinds.

One or two fawns are born late in May or in June. The young when first born are usually unspotted, but occasionally have a few irregular whitish spots on the body, which are but faintly indicated and disappear at an early age.

A noticeable peculiarity of these animals is the clicking sound made

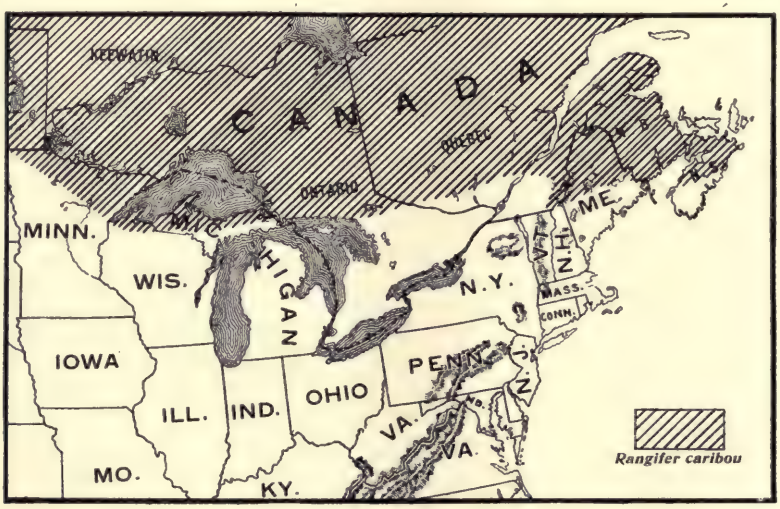
* Miller states that in 1896 Caribou were abundant on the north shore of Lake Superior; he saw heads, antlers, and jaws of these animals at White River, Peninsular Harbor, Schrerber, and Nepigon (*l. c.*, p. 40).

† Proc. U. S. Nat. Mus., XXVIII, 1905, p. 680.

by their ankle joints when in motion, and which can be distinctly heard at a distance of forty or fifty feet. When several are moving together the crackling sounds are continuous.

In the Caribou the secondary hoofs are much larger and more functional than in others of our Deer and play an important part in the economy of the animal. Caton says,* "In traveling through the snows, or soft marshy ground, the Caribou throws his hind feet forward, so as to bring the leg into something of a horizontal position, spreads wide his claws, and broad accessory hoofs, and thus presents an extraordinary bearing surface to sustain him on the yielding ground, and so he is enabled to shuffle along with great rapidity, where any other large quadruped would mire in a bog, or become absolutely snow-bound."

While, so far as known, no attempt has been made by our native inhabitants to domesticate these animals, the Old World Reindeer



Map illustrating the approximate range of the Woodland Caribou (*Rangifer caribou*) in eastern North America. North of about latitude 55° it is replaced by *R. arcticus* and in New Foundland by *R. terraenovæ*.

Rangifer caribou (GMEL.). Type locality — Eastern Canada. Description as previously given.

Rangifer terraenovæ BANGS. (Prelim. Descript. New Foundland Caribou, Nov. 11, 1896, p. 1). Type locality — Codroy, New Foundland. Paler than *caribou*, with a whitish ring around the eye; antlers larger and heavier.

Rangifer arcticus (RICHARDSON) (Fauna Bor. Amer., I, 1829, p. 241.) Type locality — Arctic Coast of America. Smaller than *caribou;* paler and grayer, becoming whitish in winter; antlers smaller.

* Antelope and Deer of America, 1877, p. 90.

(*Rangifer tarandus*), a species closely allied to our Caribou, are kept in great herds by natives of northern Europe and Asia. In the majority of cases these herds number a few hundred, but it is claimed among the Koreki that herds of thirty and forty thousand are found.

Some years ago several thousand domesticated Reindeer from East Siberia were successfully imported into northwest Alaska and distributed among the Eskimos, where it is hoped they will prove as useful to the inhabitants of that barren country as they have for hundreds of years to Old World tribes in northern Siberia, Lapland, and elsewhere. What their value has been to them may be estimated when it is known that they depend largely upon the flesh of the Reindeer for their food in winter. The skins are used for garments and a variety of other purposes; even the sinews are made into a very serviceable strong thread. The living animal has enabled the nomadic tribes to solve the problem of transportation, as the animals have been trained to carry burdens and to draw sleds. In addition to this the milk of the cow Reindeer, while small in quantity, is very rich and is much used in the manufacture of native cheese.

Before closing my remarks concerning the Old World Reindeer, a quotation from the pen of one of the ancient writers may be of interest. In 1607 Edward Topsell wrote:

"The King of Swetia had ten of them nourished at Lappa which he caused every day to be driven into the mountains into coldeayer, for they were not able to endure the heat. The mouth of this beast is like the mouth of a cow, they many times come out of *Laponia* and *Swetia*, where they are wonderfuly anoied with wolvs, but they gather themselves together in a ring, and so fight against their enemies with their hornes. They are also in their owne naturall countrey anoied with Goulons, and generally all beastes that live uppon the spoiles of flesh, are enemies unto them, and desire to destroy and eate them. In their pace, both slow and speedie, the Articles of their legs make a noise like the cracking of Nuts. There was one of these beasts given unto the Duke of Saxony in the year of our Lord 1561.

"In *Scandinavia* they use them for the carriadge of mettels, drawing of Chariots and riding, and the nerves of them when they are dead make bows, and for want of nailes, they do fasten plankes and boords togither."*

* Historie of Foure Footed Beastes, Lond., 1607, p. 593.

American Bison or Buffalo (*Bison bison*).

Family BOVIDÆ. Bison, Oxen, Sheep, etc.

Horns curved and cylindrical, simple (not branched), hollow and permanent (not annually shed), usually present in both sexes; lachrymal bone almost always articulating with the nasal; no canine teeth or incisors in upper jaw; canines in lower jaw resembling incisors; stomach divided into four compartments as in most other Ruminants; gall bladder present;* lateral digits represented by "false hoofs" or absent. A widely distributed family, including the American Bison or Buffalo, Oxen, Sheep, Goats, etc., as well as the true Antelopes, but not the so-called American Antelope or Pronghorn which is usually placed in a family by itself.† Three subfamilies are represented in North America: Bison (*Bovinæ*); Musk-oxen (*Ovibovinæ*); and Mountain Sheep and Goats (*Caprinæ*).

Genus **BISON** H. Smith.

Bison H. Smith, Griffith's Cuvier Animal Kingdom, V, 1827, p. 373.
Type *Bos bison* Linn.

Horns curved and cylindrical, hollow and permanent; body covered with woolly hair; head, part of neck and upper fore legs covered with long, shaggy hair; a "hump" on shoulders due to unusually long vertebral spines at that point; horns and hoofs black.

Dental formula: I. $\frac{0-0}{3-3}$, C. $\frac{0-0}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3} = 32$.

The living representatives of this genus are the American Bison and its northern race, the Wood Bison, together with the European Bison (*B. bonasus*), which still exists in parts of Lithuania, Roumania, and the Caucasus.

Bison bison (LINN.).

AMERICAN BISON. BUFFALO.

[*Bos*] *bison* LINNÆUS, Syst. Nat., X ed., 1758, p. 72.
B[*ison*] *bison* JORDAN, Man. Vert. Anim., 5th ed., 1888, p. 337.
Bison bison GARMAN, Bull. Essex Inst., XXVI, 1894, p. 4 (Kentucky). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 177 (Tennessee). OSBORN, Annals of Iowa, VI, 1905, p. 563 (Iowa).

* Except in *Cephalopus*.

† Dr. M. W. Lyon considers the American Antelope to belong to the family *Bovidæ*. (Proc. U. S. Nat. Mus., XXXIV, 1908, p. 398.)

Bison americanus ALLEN, Ninth Ann. Rept. U. S. Geol. Surv., 1875 (1877), p. 445 (Illinois, Wisconsin, Indiana, Michigan, Iowa, Missouri, Minnesota, etc.).

Bison Americanus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). AUDUBON & BACHMAN, Quadrupeds of N. Amer., II, 1854, p. 32 (Illinois and Indiana). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 580 (Cook Co., Illinois). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 42 (Iowa).

Bos Americanus THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 660 (Illinois). HOY, Trans. Wis. Acad. Sci. Arts & Letters, V, 1882, p. 256 (Wisconsin).

Type locality — Southeastern United States.

Distribution — Formerly ranging from Great Slave Lake south to northern Mexico and eastward throughout the greater part of the United States to Pennsylvania, Virginia, Georgia and South Carolina; now practically extinct except in Yellowstone Park and private preserves. A closely allied northern race (*B. bison athabascæ*) still exists in a wild state in the Great Slave Lake and Mackenzie regions.

Description — *Adult male:* Horns black, curved outward and upward; general color of upper parts, sides of body and back of hump pale brown; under parts dark brown; shoulders, including "hump" and upper neck, thickly covered with long brownish hair; head, neck and fore legs to the knees covered with long, shaggy, blackish brown hair; feet black. Length about 10 to 11 ft.; height at shoulder between 5 and 6 ft.; weight about 2,000 lbs.

Adult female: Smaller; the body somewhat darker and hair of head and neck shorter; height at shoulder between 4 and 5 feet; weight 700 to 1,000 lbs.

Young calves are yellowish brown, palest on the under parts. The number of calves at a birth is usually one, rarely two.

Of all the countless numbers of Buffalo which roamed throughout the United States a hundred years ago, roughly estimated at from 40,000,000 to 50,000,000, only about 2,000 probably remain alive to-day, all of which are preserved in government reservations or in private parks.

Some idea of the slaughter of these animals during the last years, when they were still to be found in any numbers, and the rapidity with which they disappeared may be gained from the shipments of their skins from stations on the Northern Pacific R.R.*: In 1882, 200,000; 1883, 40,000; 1884, 300; 1885, 0. In 1885, at almost every town along the line of the road, great piles of their bones were to be

*Hornaday, W. T. Ext. Amer. Bison, 1889, p. 513.

seen piled up ready for shipment. At Billings alone I saw a huge pile estimated at many car-loads, and it is claimed that in that year as many as 200 tons of bones were shipped by a single firm in Miles City to be ground for manufacture of fertilizers.

In the early seventies Buffalo were still numerous, although in greatly diminishing numbers, but by 1885 very few were left. In 1888 I saw in Denver, Colorado, eight fresh skins which it was said were killed in a region called Lost Park, in Park County, and the owner claimed that there were several more Buffalo there at that time, which had not been killed. This proved to be the case and it is claimed that in 1890 the herd numbered some twenty individuals. They were gradually killed off until in the winter of 1896–97 there were but four left, two bulls, a cow and a calf. Mr. T. J. Holland, State Game and Fish Commissioner for Colorado, informs me that these were all killed in Lost Park in February, 1897. The skins and bones were preserved, and in 1910 the specimens were mounted by Mr. J. C. Miles of Denver, and at the present time (February, 1911) are on exhibition in a clothing store in that city. According to Mr. E. T. Seton* the last record he has been able to find is that of four Buffalo having been killed in Texas in 1889. Therefore it is fair to assume that the year 1897 saw the last of the Wild Buffalo in the United States.

So far as known the first Buffalo was seen in a wild state by a European in the year 1530, when Cabeca de Vaca met with it in "Florida,"† although a captive specimen in the possession of Montezuma in Mexico was seen by Cortez in 1521.‡ According to Davis, C. de Vaca was wrecked at some point on the coast of Louisiana and journeyed westward.§ In his journal he describes seeing Buffalo, and we are led to infer that the locality was somewhere in the southeastern part of Texas. He says, "Cattle come as far as this. I have seen them three times and eaten of their meat. I think they are about the size of those of Spain. They have small horns like those of Morocco, and the hair long and flocky like of the merino. Some are light brown (*pardillas*), and others black. To my judgment the flesh is finer and sweeter than that of this country. The Indians make blankets of those that are not full-grown, and of the larger they make shoes and bucklers. They come as far as the sea-coast of Florida, and in a direc-

* Seton, E. T. Life Histories of Northern Animals, I, 1909, p. 296.

† French, B. F. Historical Collections of Louisiana, Part II, 1846–53, p. 1. (Florida at that time included all the country south of Virginia and westward to the Spanish possessions in Mexico.)

‡ Solis, Antonio de. Historia de la Conquista de Mexico, 1684. (Edition of 1724 quoted above.)

tion from the north, and range over a district of more than four hundred leagues. In the whole extent of plain over which they roam, the people who live bordering upon it descend and kill them for food, and thus a great many skins are scattered throughout the country."* A few years later (1542) Coronado saw vast herds of Buffalo in the country bordering the upper Pecos River and observed them continually during his journey across the plains of northern Texas. Gomara says, "All that way & plaines are as full of crooke-backed oxen, as the mountaine Serena in Spaine is of sheepe. . . . These Oxen are of the bignesse and colour of our Bulles, but their hornes are not so great. They have a great bunch upon their fore shoulders, and more haire on their fore part than on their hinder part: and it is like wooll. They have as it were an horse-mane upon their backe bone, and much haire and very long from the knees downeward. They have great tuffes of haire hanging downe their foreheads, and it seemeth they have beardes, because of the great store of haire hanging downe at their chinnes and throates. The males have very long tailes, and a great knobbe or flocke at the end: so that in some respect they resemble the Lion, and in some other the Camell. They push with their hornes, they runne, they overtake and kill an horse when they are in their rage and anger. Finally, it is a foule and fierce beast of countenance and forme of bodie."†

Early explorers continually refer to the vast numbers of Buffalo in Illinois. The Jesuit missionary, Father Marquette, writes (1673): "Having descended the river [Mississippi] as far as 41° 28,‡ we find that turkeys have taken the place of game, and the *Pisikious* that of other beasts. We call the Pisikious wild buffaloes, because they very much resemble our domestic oxen;" and later he adds "they graze upon the banks of rivers, and I have seen four hundred in a herd together.§ Describing the country bordering the Illinois River, he says, "I never saw a more beautiful country than we found on the river. The prairies are covered with buffaloes, stags, goats."¶

La Salle (1680) ascended the St. Joseph River, crossed the portage to the Kankakee and followed its course downward until it joined the north branch of the Illinois. He writes, "far and near the prairie was alive with buffalo; now like black specks dotting the distant swell;

*Davis's Translation, in his "Spanish Conquest of New Mexico," 1869, p. 67.

† Translation from Gomara's Historia general de las Indias, Saragossa, 1552–53, cap. 214. (In Hakluyt, R., Principal Navigations, Voyages, Traffiques and Discoveries of the English Nation, III, 1600, pp. 455–456; ex. ed. 1810.)

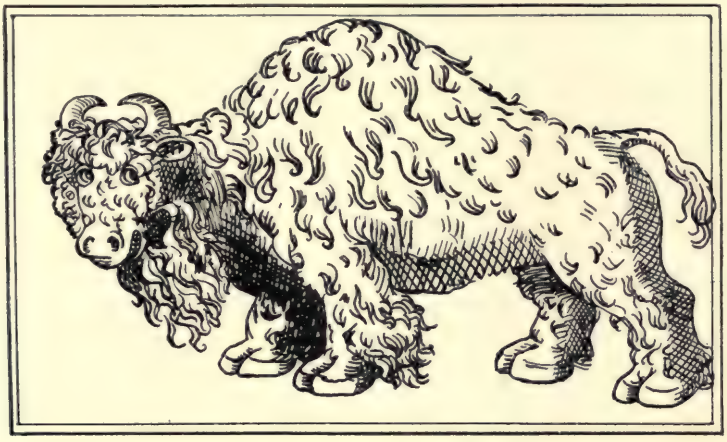
‡ Not far from Rock Island, Illinois.

§ French, B. T. Historical collections of Louisiana, Part II, 1846–53, p. 285

¶ French, B. F. *l. c.*, Part II, p. 297.

now trampling by in ponderous columns or filing in long lines, morning, noon and night, to drink at the river — wading, plunging, and snorting in the water; climbing the muddy shores, and staring with wild eyes at the passing canoes."*

Other Jesuit missionaries, including Marest, Gravier, Charlevoix, and Hennepin have written concerning the abundance of Buffalo observed by them during their travels in Illinois.† Charlevoix (1721) while crossing from St. Joseph River to the "Theakiki" [Kankakee]



Earliest known picture of a Buffalo as given in Gomara's Historia general de las Indias, 1852–53.

soon found them in abundance. He says, "The country begins to be fine: The meadows here extend beyond Sight, in which the Buffalo go in Hurds of 2 or 3 hundred."‡ In describing the country bordering the Illinois River below the junction of the Kankakee, he says, "In this Route we see only vast Meadows, with little Clusters of trees here and there, which seem to have been planted by Hand; the Grass grows so high in them, that one might loose ones self amongst it; but everywhere we meet with Paths that are as beaten as they can be in the most populous Countries; yet nothing passes through them but Buffaloes, and from Time to Time some Herds of Deer and some Roe-Bucks. . . . The 6th [October, 1721] we saw a great Number of Buffaloes crossing the River in a great Hurry."‡

Vaudreuil describes the abundance of these animals in the vicinity of the Rock River in 1718. From the bluffs along the river, he

* Parkman, Discovery of the Great West, Boston, 1869, p. 204.

† Kip, W. I. Early Jesuit Missions in North America, N. Y., 1846.

‡ Letters, Goadby's Eng. edit., 1763, pp. 280 and 290. (Copied from J. A. Allen's History American Bison, 1877, p. 501.)

says, "you behold roaming through the prairie herds of Buffalo of Illinois."*

Hennepin writes:† "There must be an innumerable quantity of wild Oxen in that Country, since the Earth is cover'd with their Horns. The *Miamis* hunt them towards the latter end of *Autumn.*

"We continu'd our Course upon this River very near the whole Month of *December;* but toward the latter end of the said Month, 1679, we arriv'd at the Village of the *Illinois,* which lies near one hundred and thirty Leagues from Fort *Miamis,* on the Lake of the *Illinois.* We suffer'd very much in this Passage, for the Savages having set the Herbs of the Plain on Fire, the wild Oxen were fled away, and so we cou'd kill but one, and some Turkey-Cocks. God's Providence supported us all the while; and when we thought that the Extremities we were reduced to, were past all hope of Remedy, we found a prodigious big wild Ox lying fast in the Mud of the River. We kill'd him, and had much ado to get him out of the Mud." (p. 113.)

"These Oxen have fine Wool instead of Hair, and their Cows have it longer than the Males; their horns are almost black, and much bigger, tho' somewhat shorter than those of *Europe.* Their Head is of a prodigious bigness, as well as their Neck, which is very short, but about six Spans broad: They have a kind of a Bump between the two Shoulders: Their Legs are big and short, covered with long Wool; and they have between the two Horns an ugly Bush of Hair, which falls upon their Eyes and makes them look horrid. . . . There is also amongst them abundance of Stags, Dears, and wild Goats."‡ (pp. 114–115.)

Audubon and Bachman say, "In the days of our boyhood and youth Buffaloes roamed over the small and beautiful prairies of Indiana and Illinois and herds of them stalked through the open woods of Kentucky and Tennessee, but they have dwindled down to a few stragglers, which resorted chiefly to the Barrens towards the years 1808 and 1809 and soon after entirely disappeared. Their range has since that period gradually tended Westward." (*l. c.*, p. 36.) Regarding its former range the same authors say, "The Bison formerly existed

* New York coll. of MSS., Paris Doc., VII, p. 890. (Copied from J. A. Allen's History American Bison, 1877, p. 501.)

† Hennepin, L. A New Discovery of a Vast Country in America, London, 1698.

‡ Hennepin makes numerous references to "Wild Goats," as on page 98, writing of his travels along the west shore of Lake Michigan, he says, "Our Savage killed several Staggs and Wild Goats, and our Men a great many Turkey-Cocks very fat and big." Dr. Hoy suggests the "wild Goats" referred to may have been Antelopes (*Antilocapra americana*), as at a comparatively recent date "Antelopes were not uncommon in southern Minnesota, only 40 miles west of the Mississippi River." It should be borne in mind, however, that (*l. c.*, p. 65) Hennepin claims to have met with "Wild-Goats" as far east as New York. Hollister suggests (Bull. Wis. Nat. Hist. Soc., 1910, p. 31) that Hennepin's "wild Goats" were White-tailed Deer, but this explanation is hardly satisfactory, as Hennepin expressly states that with the Buffalo were "Stags, Dears and wild Goats."

in South Carolina on the Seaboard and we were informed that from the last herd seen in that state two were killed in the vicinity of Columbia. It thus appears that at one period this animal ranged over nearly the whole of North America." (*l. c.*, p. 55.)

Caton writes,* "When Hennepin and Lasalle first visited Illinois two hundred years ago, the bison abounded in prodigious numbers, although the whole country was occupied by Indian tribes who, to a great extent, lived upon them. For the next hundred years but few white men visited the country and scarcely any settled in it and yet in that time nearly all the Bison had crossed the Mississippi River; and after a most dilligent research I cannot learn that one has been seen in Illinois for the last 85 or 90 years. The last bison were observed in Illinois between 1780 and 1790."

That they were found at a later date than this in Illinois is shown by the statements of others.

André Michaux, in writing of his travels in southern Illinois, (between Kaskaskia and Fort Massac) says, "The 7th of October, 1795, my guide killed a Buffalo which he considered to be about four years old. . . . Thursday the 8th saw another Buffalo thirty toises from our road."†

Woods (1822) refers to animals frequenting the salt licks at Birk's Prairie, Illinois, and says: "The places were first used by the buffaloes, that some years ago used to frequent the prairies. A man, who resides at Birk's Prairie informed me, that eight or nine years since, he often visited the Prairies, as he was then employed, with many others, during a war with the Indians, to be on the look-out for them, and then he often saw both elks and buffaloes, but they were not numerous, as the country became settled, they moved off to the large prairies to the north and west."‡

At the time of the visit of Maximilian, Prince of Wied-Neuwied, (1832–34) he informs us that Buffalo were no longer to be found in southern Illinois. He says, "The country on the banks of the Wabash is as interesting to the zoölogist as to the botanist. Formerly there were great numbers of the bison or buffalo of the Anglo-Americans, the elks, bear, and beaver; but they are now entirely extirpated."§

In Wisconsin according to Dr. Hoy it was found at a much later

* Antelope and Deer of America, 1877, 72.

† Michaux, André. Travels into Kentucky, 1795–1796. (Translation in Thwaites's Early Western Travels, III, 1904, p. 73.)

‡ Woods, J. Two Years' Residence in the Settlement on English Prairie in the Illinois Country, 1820–1821 (1822), pp. 165–166.

§ Maximilian, Prince of Wied-Neuwied. Voyage in the interior of North America, Lloyd edition, 1833 (1843), p. 76.

date. He says: "When the last buffalo, *Bos Americanus*, crossed the Mississippi is not precisely known. Governor Dodge told me that buffalo were killed on the Wisconsin side of the St. Croix river the next year after the close of the Black Hawk war, which would be in 1833" (*l. c.*, p. 256). Sibley states in Schoolcraft's Indians that two Buffalo were killed in 1832 by Sioux Indians on the Trempeleau River in upper Wisconsin.

A letter received from Mr. E. J. Chansler of Bicknell, Knox County,* Indiana, contains some interesting notes concerning the occurrence of Buffalo in that locality in early days. He writes, "Mr. John G. Bailey (ex County recorder) told me that his grandfather came to Vincennes in 1800 and that his father was six years old when he came, and that his father could have killed Buffalo just east of town, when he got old enough to hunt, but was afraid to shoot them. This would perhaps place the last date for Buffalo in Knox County or Indiana at about 1810 or 1812.

"Mr. Brad Thompson told me his father claims to have seen Buffalo in 1808 in Knox County.

"Mr. Felix Boushie told me that his wife's grandfather, Tony Rushville, killed a Buffalo cow and calf 5 miles south of Vincennes on the Wabash in 1800.

Map illustrating probable former range of the American Bison or Buffalo (*Bison bison*) in the United States. In western Canada its range extended northward at least as far as Great Slave Lake. Compiled from maps given by Dr. J. A. Allen, monograph of the American Bison; Dr. W. T. Hornaday, Extermination of the American Bison; Mr. E. T. Seton, Life Histories of Northern Animals, together with records by various early writers.

* Knox County, Indiana, is separated from Lawrence Co., Illinois, by the Wabash River.

"Old men tell me that marks of the old Buffalo trail 9 miles south of Vincennes, where the Buffalo crossed the Wabash River from the vast prairies of Illinois en route to the blue grass and lick regions of Kentucky, are still visible."

For many years after Buffalo had disappeared from Illinois and Wisconsin they were found in considerable numbers in Iowa and Missouri. Dr. J. A. Allen states in 1867 he was informed that a few still remained in Iowa, and that up to that time one or more had been killed every year as far south as Green County.*

Farther west, however, at this time great herds still roamed the Plains. Col. R. I. Dodge, while travelling from Old Fort Zara to Fort Larned on the Arkansas River in May, 1871, states that for 25 miles he passed through an immense herd of these animals. He says, "The whole country appeared one mass of buffalo, moving slowly to the northward."† In a letter to Dr. Hornaday, dated September 21, 1887, he writes: "The great herd on the Arkansas through which I passed could not have averaged, *at rest*, over fifteen or twenty individuals to the acre, but was, from my own observation, not less than 25 miles wide, and from reports of hunters and others it was about five days in passing a given point, or not less than 50 miles deep. From the top of Pawnee Rock I could see from 6 to 10 miles in almost every direction. This whole vast space was covered with buffalo, looking at a distance like one compact mass, the visual angle not permitting the ground to be seen."‡

Hornaday estimates that in 1870, shortly after the completion of the Union Pacific Railroad, there were about four million Buffalo south of the Platte River and probably one million and a half north of it. He estimates that 3,698,730 animals of the Southern herd were killed during the years 1872, 73, and 74, and of these, 3,158,730 were killed by hide and meat hunters, less than half being utilized. The Atchison, Topeka, and Sante Fé Railroad carried in those years, 459,453 hides; and other roads about twice as many (*l. c.*, pp. 498–499). This was the beginning of the end and a few years later all that was left to mark the former presence of the countless herds of these splendid animals were their whitened skulls and bones scattered about the plains.

* Proc. Bost. Soc. Nat. Hist., XIII., 1869 (1871), p. 186.

† The Plains of the Great West, 1877, p. 120.

‡ Extermination of the American Bison, Rep. U. S. Nat. Mus., 1887 (1889), p. 390.

Skulls of Rodents (Order Glires).

1, Gray Squirrel (Genus *Sciurus*); 2, Varying Hare (Genus *Lepus*); 3, Jumping Mouse (Genus *Zapus*); 4, Pocket Gopher (Genus *Geomys*); 5, Brown Rat or House Rat (Genus *Epimys*); 6, Porcupine (Genus *Erethizon*). (About ¾ nat. size.)

Order GLIRES.

GNAWING MAMMALS.

The order Glires, formerly known as Rodentia, has the distinction of being the largest as well as the most widely distributed throughout the world. Its members are characterized by strongly developed chisel-like incisors in both jaws and the absence of canine teeth, leaving a wide gap between the large chisel-shaped front teeth and the "back teeth." There is a great diversity in form and habits among its members: some are strictly terrestrial; others, such as the Muskrat, are semi-aquatic, passing the greater part of their lives in the water; others again are arboreal, such as many of the Squirrels. In size they vary from the diminutive Mouse to the South American Capabara (a relative of our familiar Guinea Pig), the giant of its order, often weighing more than 100 pounds.

There is also considerable variation in the osseus systems of the various families, as, for example, the clavicle (collar bone) is well developed in the *Sciuridæ*, but is imperfect or rudimentary in the *Leporidæ*. A zygomatic arch is always present but the position of the jugal therein is variable. In the Rats and Mice the *tibia* and *fibula* (lower leg bones) are fused together, but are separate in the Squirrels and Porcupines. However, such variations would be expected in animals of such great diversity of habits, but whatever other skeletal differences exist the dental characters are peculiar and diagnostic.

The members of the order are separated into two suborders: I, Simplicidentata or simple toothed, Rodents having but 2 incisors in the upper jaw; and II, Duplicidentata, those which have 4 incisors in the upper jaw, the second pair being very small and placed directly behind the others. The latter suborder contains but two living families, the *Ochotonidæ* and the *Leporidæ* in which are included our Rabbits and Hares. No living Rodent has more than two lower incisors, and those belonging to the family *Muridæ* have but three cheek teeth (molars) and apparently lack milk dentition. Other important characters for the order are a large cæcum, which is nearly always present, testes abdominal or inguinal and placenta discoidal and deciduate. All the members of the order are more or

Skull of a Rodent.

less herbivorous and many of them are practically omnivorous. Of the large number of families belonging to this great order, 10 are represented in North America, of which 7 occur within our limits.

KEY TO THE SUBORDERS AND FAMILIES.

GROUP 1. Upper incisors 2 (**Suborder SIMPLICIDENTATA**), p. 98.

SECTION 1. Body largely covered with sharp, stiff spines or quills partly concealed by fur. **Family ERETHIZONTIDÆ. American Porcupines,** p. 253.

SECTION 2. Body not largely covered with sharp quills.

PART 1. Tail broad, flattened (paddle shaped), naked, and scaly; size large. **Family CASTORIDÆ. Beavers,** p. 158.

PART 2. Tail not broad, flattened and paddle shaped.

A. Hind legs and feet noticeable elongated (kangaroo-like). Tail very long; size small (about that of a Mouse). **Family ZAPODIDÆ. Jumping Mice,** p. 246.

B. Hind legs and feet ordinary, not greatly elongated.

b1. Tail closely or scantily haired or naked.

Claws of fore feet not greatly elongated; no external cheek pouches. **Family MURIDÆ. Rats, Mice, etc.,** p. 171.

Claws of fore feet greatly elongated; external cheek pouches present. **Family GEOMYIDÆ. Pocket Gophers,** p. 239.

b2. Tail thickly haired and more or less bushy. **Family SCIURIDÆ. Squirrels, Woodchucks, etc.,** p. 98.

GROUP 2. Upper incisors 4, the second pair much smaller and placed behind the front pair. (**Suborder DUPLICIDENTATA**), p. 258.

Ears long; hind legs long. **Family LEPORIDÆ. Hares and Rabbits,** p. 259.

Suborder SIMPLICIDENTATA.

Family SCIURIDÆ. Squirrels, Woodchucks, etc.

The *Sciuridæ* are a highly specialized and widely distributed family, being cosmopolitan with the exception of the Australian region. Some exotic species are highly colored, showing much red, orange and yellow. They vary in size from the diminutive *S. soricinus* of Borneo, which is about the size of a Mouse, to the Malayan species, *S. bicolor*, which is as large as a Cat. A cæcum is always present, which in most of our species will average from one-seventh to one-ninth the length of the large intestine.

Those which occur within our limits differ greatly in form and

habits, varying from the arboreal and semi-aerial little Flying Squirrel to the terrestrial and burrowing Woodchuck or "Groundhog." In all the species the lower leg bones are separate and the skull shows well marked post-orbital processes. The tail is always more or less bushy (never bare or scaly). Generally there are two premolars on each side of the upper jaw, but the first is always small and often absent. The molars are tuberculate and rooted. Some species hibernate in this latitude and some do not. Squirrels' hair is used in the manufacture of the so-called "Camel's hair" brushes.

KEY TO THE GENERA

IN ILLINOIS AND WISCONSIN.

GROUP 1. Length of body, without tail, (nose to root of tail) more than 14 inches; tail less than ¼ total length of body and tail. Genus MARMOTA, p. 150.

GROUP 2. Length of body, without tail, less than 14 inches; tail ¼, or more, total length of body and tail.

SECTION 1. Back with several distinct stripes.

Back with four pale stripes and several black ones; no rows of round pale spots. Genus EUTAMIAS, p. 135.

Back with two pale stripes and several black ones; no rows of round pale spots. Genus TAMIAS, p. 128.

Back with rows of pale, rounded spots down middle of each dark stripe. Genus CITELLUS, p. 137.

SECTION 2. Back without several distinct stripes; front and hind legs not joined together by a thickly furred expansion of loose skin.

PART 1. General color largely gray or grayish.

Hairs distinctly vermiculated with black; tail vertebræ always less than 6½ inches long. Genus CITELLUS, p. 137.

Hairs not distinctly vermiculated with black; tail vertebræ more than 6½ inches long. Genus SCIURUS, p. 108.

PART 2. General color largely red brown, tawny or yellowish. Genus SCIURUS, p. 108.

SECTION 3. Back without distinct stripes; front and hind legs joined together by an expansion of loose skin extending laterally from side of body. Genus SCIUROPTERUS, p. 102.

KEY TO THE SPECIES.

GROUP 1. Length of body, without tail, (nose to root of tail) more than 14 inches long.

General color grizzly brown; feet brownish black; about size of Domestic Cat or larger. Occurs in Illinois and Wisconsin. WOODCHUCK, GROUND HOG. *Marmota monax*, p. 150.

Similar but smaller, and under parts more rusty brown. Occurs in extreme northern Wisconsin. CANADA WOODCHUCK. *Marmota monax canadensis*, p. 157.

GROUP 2. Length of body, without tail, (nose to root of tail) more than 8 inches but less than 14 inches long.

SECTION 1. Back marked with several distinct stripes. Back striped and spotted. STRIPED GROUND SQUIRREL, STRIPED GOPHER.
Citellus tridecemlineatus, p 138.

SECTION 2. Back not marked with several distinct stripes.

PART 1. General color largely gray; under parts white or whitish.

Hairs on tail broadly tipped with white; entire length, including tail vertebræ, 16 to 18 inches; usually 5 cheek teeth on each side of upper jaw (2 premolars and 3 molars); front premolar very small and not always present; tail vertebræ always more than 6½ inches long. Occurs within our limits only in southern Illinois.
SOUTHERN GRAY SQUIRREL. *Sciurus carolinensis*, p. 115.

Similar to preceding but slightly larger; total length, including tail vertebræ, 18 to 20 inches; tail vertebræ always more than 6½ inches long; back clear gray, without rusty tinge in winter; usually 5 cheek teeth (2 premolars and 3 molars) on each side of upper jaw, but front premolar very small and not always present. Occurs within our limits in northern Illinois and throughout Wisconsin.
NORTHERN GRAY SQUIRREL.
Sciurus carolinensis leucotis, p. 116.

PART 2. General color not gray; under parts white or whitish.

Upper parts and tail reddish brown; entire length, including tail vertebræ, between 12 and 14 inches. RED SQUIRREL. CHICKAREE.
Sciurus hudsonicus loquax, p. 122.

PART 3. General color not gray; under parts not white or whitish.

General color more or less tawny or pale rufous; only 4 cheek teeth on each side of upper jaw (1 premolar and 3 molars); hairs on tail broadly tipped with rufous brown; nose to root of tail, 11 to 13 inches; tail vertebræ, 9 to 10 inches; total length, about 21 to 23 inches.
WESTERN FOX SQUIRREL. *Sciurus niger rufiventer*, p. 109.

General color grayish brown; tail gray, marked with black, the hairs tipped with white; nose to root of tail, 9½ to 10 inches; tail vertebræ, 5 to 5½ inches, always less than 6½ inches long; total length about 15 inches. Lives in holes in the ground.
FRANKLIN'S GROUND SQUIRREL. GRAY GOPHER.
Citellus franklini, p. 144.

General color black or partly black; total length, including tail vertebræ, less than 20 inches; usually 5 cheek teeth on each side of upper jaw (2 premolars and 3 molars), but front premolar very small and not always present. GRAY SQUIRREL (black phase).
Sciurus carolinensis or *Sciurus carolinensis leucotis*, pp. 115–116.

General color black or partly black; total length, including tail vertebræ, 20 or more inches; 4 cheek teeth on each side of upper jaw (1 premolar and 3 molars). WESTERN FOX SQUIRREL (black phase).
Sciurus niger rufiventer, p. 109.

GROUP 3. Length of body, without tail, (nose to root of tail) less than 8 inches.

SECTION 1. Back marked with several distinct stripes.

Back with but 2 whitish stripes and 5 black ones; rump rufous chestnut; nose to root of tail, about 5 inches; tail vertebræ, 3 to 3½ inches. Occurs within our limits from northern Illinois southward.

CHIPMUNK. *Tamias striatus*, p. 128.

Similar to preceding but somewhat larger; general color grayer and rump pale cinnamon brown with only a slight rusty tinge; spaces between black stripes on back distinctly grayish nearly to the rump; nose to root of tail, about 5½ inches; tail vertebræ, about 3½ inches. Occurs in northern Illinois and northward throughout Wisconsin.

GRAY CHIPMUNK. *Tamias striatus griseus*, p. 130.

Back with 4 pale stripes and 5 black ones; face with *whitish stripe* above and below the eye; size small; nose to root of tail, about 4½ inches; tail, about 3½ inches. Occurs within our limits only in northern Wisconsin.

LITTLE CHIPMUNK. *Eutamias borealis neglectus*, p. 135.

Back with alternating pale and dark brown stripes, each dark stripe with row of pale rounded spots down the middle; nose to root of tail, about 7½ inches; tail, about 3½ inches.

STRIPED GROUND SQUIRREL. STRIPED GOPHER. *Citellus tridecemlineatus*, p. 138.

SECTION 2. Back not marked with several distinct stripes.

PART 1. Front and hind legs joined together by thickly furred expansion of loose skin extending laterally from sides of the body.

Fur on under parts entirely white to the base; nose to root of tail vertebræ, about 4 inches; total length, about 9½ inches. Occurs throughout whole of Illinois and southern two-thirds of Wisconsin.

FLYING SQUIRREL. *Sciuropterus volans*, p. 102.

Similar to preceding but larger and fur on under parts tipped with white, but plumbeous gray at base instead of all white; nose to root of tail, about 6½ inches; tail vertebræ, about 5 inches; total length, about 11½ inches.

NORTHERN FLYING SQUIRREL. *Sciuropterus sabrinus*, p. 106.

PART 2. Front and hind legs not joined by an expansion of loose skin extending laterally from the body.

Upper parts reddish brown; under parts white or whitish; upper surface of tail reddish brown, the hairs near the end subterminally marked with black; entire length, including tail vertebræ, between 12 and 14 inches.

RED SQUIRREL. CHICKAREE. *Sciurus hudsonicus loquax*, p. 122.

Subfamily PTEROMYINÆ.

Genus **SCIUROPTERUS** Cuvier.

FLYING SQUIRRELS.

Sciuropterus F. Cuvier, Dents du Mammifères, 1825, p. 255. Type *Sciurus volans* Linn.

Tail flat, thickly haired laterally; legs and body connected by loose skin which, when extended, becomes wing-like, enabling the animal to sail on a downward slant for a considerable distance; fur very soft and thick; occipital region depressed; rostrum short; infra-orbital foramen small and confined to lower part of maxillary; post-orbital process narrow and pointed (spine like); audital bullæ large; eyes large. Two species occur within our limits.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3} = 22$.

KEY TO OUR SPECIES.

Total length usually less than 10 inches; fur of belly white to base.
SOUTHERN FLYING SQUIRREL. *Sciuropterus volans*, p. 102.

Total length usually more than 10 inches; fur of belly dark at base.
NORTHERN FLYING SQUIRREL. *Sciuropterus sabrinus*, p. 106.

Subgenus **GLAUCOMYS** Thomas.

Sciuropterus volans (LINN.).

FLYING SQUIRREL. SOUTHERN FLYING SQUIRREL.

[*Mus*] *volans* LINN., Syst. Nat., X ed, I, 1758, p. 63.

Sciuropterus volans JORDAN, Man. Vert. Anim., 1890, p. 324. GARMAN, Bull. Essex Inst., XXVI, 1894, p. 5 (Kentucky). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 131 (Indiana). HAHN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 459 (Illinois). *Ib.*, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 485 (Indiana). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 197 (Tennessee). SNYDER, The Oregon Naturalist, IV, 1897, p. 9 (Wisconsin). *Ib.*, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 118 (Dodge Co., Wisconsin). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 70 (Missouri). *Ib.*, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 19 (Wisconsin). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 533 (Champaign Co., Illinois).

Sciuropterus volans volans BANGS, Proc. Biol. Soc. Wash., X, 1896, p. 162 (Missouri, Indiana, etc.).

Sciuropterus volucella HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 159 (Minnesota).

Pteromys volucella AUDUBON & BACHMAN, Quadrupeds N. Amer., I, 1846, p. 216. LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 69 (Illinois). *Ib.*, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 189 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin).

Type locality — Virginia.

Distribution — Southern New England to northern Georgia westward (except in the mountains); south of the Great Lakes and north of Alabama to Minnesota, Iowa and eastern Kansas; replaced in the South by a slightly different race — (*S. v. querceti*).

Special characters — Hair on under parts entirely white to the base; fur very soft.

Description — In summer: Upper parts grayish brown, more or less washed with russet brown, usually deepest on upper surface of tail; greater portion of upper surface of flying membrane dark drab brown; under surface of tail tawny or tawny white; rest of under parts white; the hairs *entirely white to the bases.*

In winter: Similar, but the upper parts tinged with grayish brown.

Measurements — Total length, 9.25 in. (234.5 mm.); tail vertebræ, 3.90 in. (99.7 mm.); hind foot, 1.22 in. (31.2 mm.).

This graceful little animal is common in wooded districts throughout Illinois and the greater part of Wisconsin, but it is seldom seen on account of its nocturnal habits. During the day it sleeps in some hollow tree; but very late in the afternoon it occasionally, though rarely, may be seen sailing through the air on a downward slant, usually from the top of some tree to the trunk or lower branches of another, often at a considerable distance.

The nest is in a hollow tree and is composed of leaves and moss. In the majority of cases a hole formerly occupied by a woodpecker is used. The young are from 4 to 6 in number and are generally born in April in this latitude. The young Squirrels make charming pets, being very gentle and affectionate.

In a letter to Audubon and Bachman, which is quoted by them, Mr. Gideon B. Smith of Baltimore writes (*l. c.*, p. 220): "They are gregarious, living together in considerable communities, and do not object to the company of other and even quite different animals. For example, I once assisted in taking down an old martin-box, which had been for a great number of years on the top of a venerable locust tree near my house, and which had some eight or ten apartments. As the box fell to the ground we were surprised to see great numbers of Fly-

Flying Squirrel (*Sciuropterus volans*).

ing Squirrels, screech-owls, and leather-winged Bats running from it. We caught several of each, and one of the Flying Squirrels was kept as a pet in a cage for six months. The various apartments of the box were stored with hickory-nuts, chestnuts, acorns, corn, etc., intended for the winter supply of food. There must have been as many as twenty Flying Squirrels in the box, as many bats, and we know there were six screech-owls. The crevices of the house were always inhabited by Squirrels. The docility of the one we kept as a pet was remarkable; although he was never lively and playful in the day-time, he would permit himself to be handled and spread out at the pleasure of anyone. We frequently took him from the cage, laid him on the table or on one hand, and exposed the extension of his skin, smoothed his fur, put him in our pocket or bosom, etc., he pretending all the time to be asleep."

Kennicott says: "Its habitat being strictly among trees, it cannot, of course, abide on the prairies, nor is it found generally in our smaller prairie groves; though it is as abundant in the larger woods of Northern Illinois as elsewhere. The Flying Squirrel is as active as the true species, but unlike the rest of the family, it is nocturnal, and does not move about by day, except at times in cloudy weather. It prefers the twilight or darkness, when it leaves its retreat for amusement or in search of food, seldom travelling on the ground, but sailing gracefully from tree to tree, running up towards the top of one and alighting lower upon the trunk of another. It is gregarious, living in hollow trees in large companies. It usually prevails in greater numbers, wherever found at all, than is generally supposed. If, in passing through the woods, anyone will strike the sides of old hollow trees, he will frequently see a number of these singular and beautiful little animals rush out of a hole and sail off to the neighboring trees" (*l. c.*, p. 70–71).

When a nest is found the old ones are easily taken in box traps, being seemingly very unsuspicious, but without some good reason for so doing it seems a pity to deprive such beautiful little animals of their freedom.

Flying Squirrels are practically omnivorous, as among other things they eat nuts, seeds, insects, birds' eggs and often young birds.

As to whether the Flying Squirrels hibernate in the strict sense of the word I am somewhat in doubt, although it is generally believed by naturalists that they probably do, to a more or less degree, depending upon the severity of the winter. It is well known that they remain in their nests during very cold weather, but their sleep is apparently not very sound, for if a tree in which they have their winter home be

struck a few blows with a stick, they will come out and appear to be as lively as usual.

In an article in The Oregon Naturalist Mr. W. E. Snyder says, "I recall having found (at Beaver Dam, Wisconsin), in the winter of 1890, what I consider almost a large family. One side of a large burr oak tree was dead while the other was yet alive. The tree was a hollow one. Breaking in the dead shell, I found twenty-two full-grown Flying Squirrels, *Sciuropterus volans*. Of course it was several families united as one, for protection from the rigors of a Wisconsin winter" (*l. c.*, p. 9).

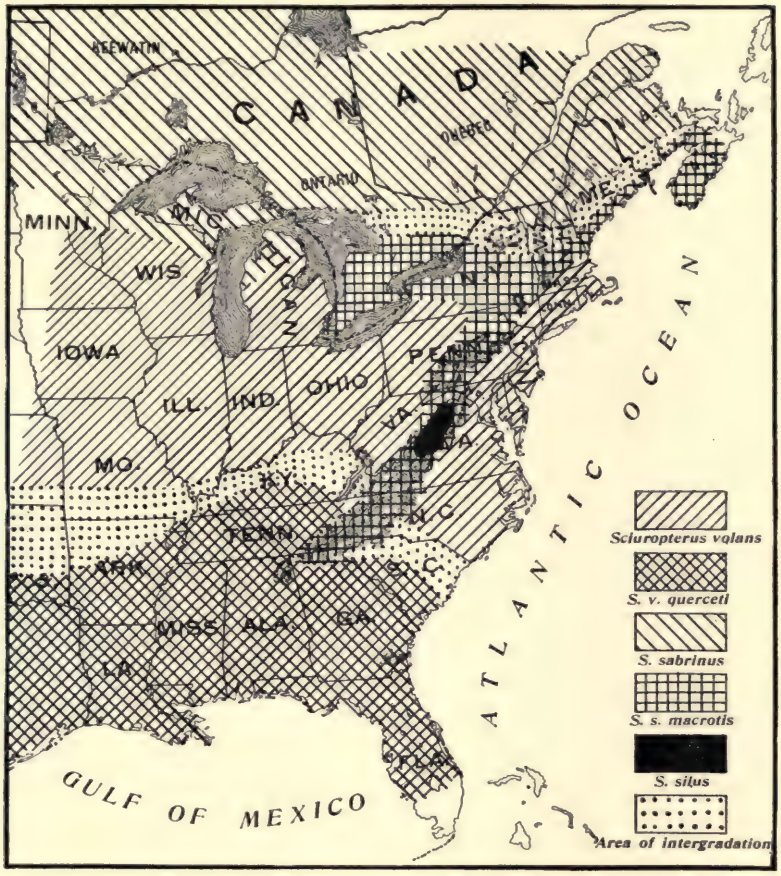
Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Willow Springs, 1; Golconda, Pope Co., 1; Warsaw, Hancock Co., 1; Olive Branch, Alexander Co., 1 = 4.
Minnesota — Aitkin, Aitkin Co., 2.
Indiana — La Porte, 1; Kankakee marshes, 1 = 2.
Iowa — Knoxville, 1.
Wisconsin — (M. P. M.) Maiden Rock, 1; Rochester, Racine Co., 1; Fountain City, 1; Pine Lake, 1; Elm Grove, Waukesha Co., 2; Burnett Co., 1; Stanley, 1; Milwaukee, 2; Milwaukee Co., 3; (O. C.) Nashotah, Waukesha Co., 8; Delafield, 1; Pewaukee, 1; (O.) Walworth Co., 2 = 25.

Sciuropterus sabrinus (SHAW).

NORTHERN FLYING SQUIRREL.

Sciurus sabrinus SHAW, Gen. Zoöl., I, 1801, p. 157.
Pteromys Hudsonicus STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin).
Sciuropterus sabrinus BANGS, Proc. Biol. Soc. Wash., X, 1896, p. 162. MILLER, Proc. Bost. Soc. Nat. Hist., XXVI, 1897, p. 34 (Nipigon, Ontario). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 19 (Wisconsin).
Pteromys sabrinus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).
Sciuropterus volucella hudsonius MERRIAM, Mamm. Adirondack Reg., 1886, p. 206.

Type locality — Severn River, Keewatin, Canada.
Distribution — Extreme northern border of eastern United States northward (see map).
Special characters — Decidedly larger than *S. volans*, and white fur on under parts plumbeous gray at base, instead of all white as in that species.
Description — *In summer:* Upper parts tawny brown, strongly tinged with drab; cheeks grayish; a narrow dark ring around the eye; flying membrane largely dark drab brown on upper surface; under



Map illustrating approximate distribution of Flying Squirrels in eastern United States. In the areas indicated by the dotted space between the ranges given for different races, either or both may occur, together with intermediate forms.

Sciuropterus volans (LINN.). Type locality — Virginia. Description as previously given.

Sciuropterus v. querceti BANGS. (Proc. Biol. Soc. Wash., X, 1896, p. 166.) Type locality — Citronelle, Citrus Co., Florida. Similar to *volans*, but upper parts more uniform russet and under parts washed with russet.

Sciuropterus sabrinus (SHAW). Type locality — Severn River, Keewatin, Canada. Description given elsewhere.

Sciuropterus s. macrotis MEARNS. (Proc. U. S. Nat. Mus., XXI, 1898, p. 353.) Type locality — Hunter Mountain, Catskill Mountains, Greene Co., New York. Smaller than *sabrinus*, more reddish in color and with longer ears.

Sciuropterus silus BANGS. (Proc. Biol. Soc. Wash., X, 1896, p. 163.) Type locality — Katis Mountain, White Sulphur Springs, West Virginia. Somewhat resembles *sabrinus*, but is darker and decidedly smaller. Length of type 214 mm. (about 8½ inches) as given by Bangs.

parts white, the *hairs plumbeous gray at base;* under surface of tail tawny or grayish according to season.

In winter: Upper parts tawny brown or pale cinnamon brown.

Measurements — Total length, about 11 in. (278.2 mm.); tail vertebræ, 1.12 in. (130.5 mm.); hind foot, 1.45 in. (37.6 mm.).

The habits of the Northern Flying Squirrel are apparently similar to its more southern relative (*S. volans*), with the exception that it is more hardy and does not hibernate in winter. Dr. C. Hart Merriam says: "The mercury may indicate a temperature many degrees below zero, or snow may be falling in quantities sufficient to obstruct the vision, without seeming in any way to dishearten this merry adventurer. The last rays of the departing sun have scarcely disappeared from the western horizon before the sombre shades that mark the approach of winter night commence to gather about the snow clad forest. Whether bright stars sparkle and shine through a frosty atmosphere, or heavy, leaden clouds overhang the scene, makes little difference to the Northern Flying Squirrel. He emerges from his warm nest, takes a hasty survey of the surroundings lest some wily owl should lurk hard by, glides silently to a neighboring tree, and starts forthwith upon his nightly tour in quest of food and sport." (*l. c.*, p. 206).

The young number from 3 to 6 and are usually born late in April.

Specimens examined from Wisconsin and adjoining states:

Wisconsin — (M. P. M.) Kelly Brook, Oconto Co., 1. (O. C.) Gordon, Douglas Co., 1; Langlade Co., 1 = 3.

Michigan — Champion, 3.

Subfamily SCIURINÆ.

Genus **SCIURUS** Linn.

Sciurus Linnæus, Syst. Nat., X ed., I, 1758, p. 63. Type *Sciurus vulgaris* Linn.

Tail long and thickly haired (bushy); eyes large and ears well developed; skull with elongated, pointed (spine-like), postorbital processes; infraorbital foramen small and confined to the lower portion of maxillary; toes with claws; front toes 5, four well developed but the fifth rudimentary, very small and hardly noticeable; anterior upper premolar when present very small.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{2-2}{1-1}$, or $\frac{1-1}{1-1}$, M. $\frac{3-3}{3-3} = 22$ or 20.

KEY TO OUR SPECIES.

A. General color largely gray or gray mixed with rusty; under parts white or whitish; ***hairs on tail*** broadly tipped with white.

Gray of upper parts more or less mixed with rusty. Occurs in about southern two-thirds of Illinois. SOUTHERN GRAY SQUIRREL. *Sciurus carolinensis*, p. 115.

Similar but slightly larger and upper parts clear gray in winter. Occurs in Wisconsin and northern Illinois. NORTHERN GRAY SQUIRREL. *Sciurus carolinensis leucotis*, p. 116.

B. General color largely tawny gray; under parts not white (usually tawny); hairs on tail broadly tipped with tawny or pale rufous.
WESTERN FOX SQUIRREL. *Sciurus niger rufiventer*, p. 109.

C. General color reddish brown; under parts white; entire length, including tail, 12 to 14 inches. RED SQUIRREL. *Sciurus hudsonicus loquax*, p. 122.

D. General color black or partly black; color phases of:
NORTHERN GRAY SQUIRREL. *Sciurus carolinensis leucotis*, p. 116.
or WESTERN FOX SQUIRREL. *Sciurus niger rufiventer*, p. 109.

Subgenus **PARASCIURUS** Trouessart.

Premolars $\frac{1-1}{1-1}$; rostrum long and broad; brain case narrow at occiput; nasals relatively broad; molars large.

Sciurus niger rufiventer (GEOFFROY).

WESTERN FOX SQUIRREL.

Sciurus rufiventer GEOFFROY, Cat. Mamm. Mus. d'Hist. Nat., 1803, p. 176.
Sciurus occidentalis AUD. & BACH., Proc. Acad. Nat. Sci. Phila., 1841, p. 102.
Sciurus vulpinus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).
Sciurus magnicaudatus KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 55.
Sciurus Sayi STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin).
Sciurus ludovicianus CUSTIS, Barton's Med. & Phys. Journ., II, 1806, p. 47. ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 188 (Iowa). MILES, Rept. Geol. Surv. Mich. I, 1860 (1851), p. 220 (Michigan). VAN HYNING & PELLETT, Proc. Iowa Acad. Sci., XVII, 1910, p. 214 (Iowa).
Sciurus niger GARMAN, Bull. Essex Inst., XXVI, 1894, p. 6 (Kentucky). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 158 (Minnesota).
Sciurus niger rufiventer OSGOOD, Proc. Biol. Soc. Wash., XX, 1907, p. 44. JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 71 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 466 (Indiana).

Type locality — Probably Lower Mississippi Valley.

Distribution — Mississippi Valley from Louisiana north to South Dakota, southern Minnesota, central Wisconsin and southern Michigan, eastward to western Pennsylvania and West Virginia.

Description — (Specimens from Fox Lake, Illinois, Oct. 31, 1906.) General color above pale tawny brown finely mixed with darker brown; tail mixed black and rufous brown, the ends of the hairs tawny rufous; ears rufous brown; under parts pale tawny; four cheek teeth (1 premolar and 3 molars) on each side of upper and lower jaws.

Remarks — No description of any one specimen will answer for this species. The individual coloration is very variable, ranging from black, part black and part tawny, to various mixtures of yellow brown, rufous and tawny. The majority of specimens, however, appear to be tawny gray-brown above and pale rufous or yellow brown or pale orange brown on the under parts, with the hairs of the tail mixed black and tawny rufous.

In any pelage its large size, tawny or rufous tipped hairs on tail, together with the presence of but four cheek teeth on each side of both jaws, will generally distinguish it from other Squirrels which occur within our limits. The Gray Squirrel, the only species with which it may be confounded, usually has 5 cheek teeth (2 premolars and 3 molars) on each side of the upper jaw, and the hairs on the tail are tipped with white.

Measurements — The following are the average measurements of 12 specimens: Total length, 21 in. (533.5 mm.); tail vertebræ, 9.50 in. (248.2 mm.); hind foot, 2.80 in. (73 mm.).

In early days the Fox Squirrel was common in many localities where it is now scarce, and few people at the present time have the opportunities for observing its habits that were accorded the earlier naturalists, therefore I can not do better than to quote Robert Kennicott concerning the habits of the species in Illinois. He says: "The fox-squirrel loves neither the low lands nor deep woods; and, though found living in the heavily timbered districts of Indiana and Illinois, it is less at home in these than in more open ground. It is properly an inhabitant of the timber of the prairie regions, and its favorite habitat is in the 'oak openings' of Wisconsin and Michigan, and the groves or edges of the belts of timber that skirt the streams watering the prairies of Illinois.

". . . In the woods, the food of the fox-squirrel consists almost entirely of the nuts and seeds of trees, with the buds of some species including bass-wood, elm and maple. In autumn, it eats the fruit of various thorns (*Cratægus*); various berries are also eaten by it, and it

Western Fox Squirrel (*Sciurus niger rufiventer*).

is said to be particularly fond of strawberries. In common with other squirrels, it sometimes eats insects; and it has occasionally been observed to gnaw the bark from dead trees, to procure beetles and their larvæ. . . . It is a common opinion that this and other squirrels carry large hoards of nuts to hollow trees for consumption in winter. So far as our three species common in Illinois, are concerned, this is entirely erroneous. With the exception of the little 'Chickaree,' no true squirrel that I have observed ever collects food for winter in hollow trees. A few nut-shells are sometimes found in a squirrel's hole, but these are only such as he has taken there to be eaten at the time. The fox-squirrel, with the migratory and Carolina squirrels, also, as well as others probably, buries large quantities of nuts and acorns under the leaves in autumn, for use in winter. These, however, are not collected together, but concealed one in a place. In winter, the squirrels dig them up; and, when the ground is covered with snow, numerous holes will be seen where they have dug down to get them. It is interesting to notice that they seldom dig through the snow and leaves in this way without coming directly upon the buried nut or acorn, and a common idea is that the animal 'remembers' the spot. This is highly improbable. It is more reasonable to suppose that the animal is guided by the sense of smell. Dr. Hoy tells me that he has seen squirrels run about with the nose close to the snow or leaves, and finally dig directly upon a buried nut without hesitation. He gives it as his opinion that they can always smell the food, unless it is buried under very deep snow. . . .

"The fox-squirrel is more solitary in its habits than the migratory squirrel*. More than two old ones are rarely, if ever, found living together. In the summer and fall, the old males lead a solitary life, as they sometimes do in winter. As soon as the young are able to take care of themselves, the female usually drives them off, when the old male, which has retired to a summer residence to escape the discomfort attendant upon the rearing of a family, returns to the winter-quarters and society of his chosen mate; for, usually this species is not polygamous. This squirrel often, if not generally, builds several nests, each of which is sometimes a simple pile of twigs and leaves placed in the forks of a tree, but at other times is carefully and ingeniously constructed, being round, with the central cavity quite roofed over, and a small entrance on the side. The more carefully-formed nests are usually on tall trees; but temporary habitations are frequently built on small trees, and within 20 feet of the ground. After being driven off by the mother, the young usually separate and lead a wandering life, for a time at least. They build nests wherever they stop, even for a day or

* Gray Squirrel.

two; and I have several times observed individuals to appear in a grove of young oaks, build a nest, remain a few days, and then disappear, perhaps to return again in a week and build other nests.

"The fox-squirrel loves to take up his abode in a hollow tree which stands out alone at a little distance from the surrounding timber, as if desirous of having a clear view of all going on around him. When he once becomes domiciled in a tree, he does not leave it, unless disturbed, pairs being observed to inhabit the same tree for five or six successive years. It is less prolific than either the migratory or Carolina squirrel. From two to four young are usually brought forth at a birth, the most common being three; but in one instance I have seen five. Two litters are probably produced each season. So far as has been observed, they are always brought forth in the hole, the nest of leaves being used only as summer-houses. Like the young of most rodents, they are ugly, unsymmetrical little beings, at first, with monstrous heads and closed eyes; and it is some time before they acquire the elegant proportions and agile movements of their parents.

"These squirrels sometimes leave their holes for food and even for amusement, in very cold and rainy weather, when they are found moving about much more than the migratory species. But, though active at this time and apparently engaged in play, they do not now 'bark' as on warm and pleasant days." (*l. c.*, pp. 56–59, 61.)

Regarding the Fox Squirrel's habit of burying nuts in the ground, Mr. E. T. Seton writes, "On the first of August, 1903, I watched for an hour the Fox-squirrels of City Park, Madison, Wis. A large male that seemed master of those near came forward as I offered him some peanuts. The first three he ate, the rest he buried. His procedure was the same each time; seizing the nut in his teeth, then in his paws, he turned it two or three times in his mouth and appeared to be licking it." (Life Histories of Northern Animals, I, 1909, p. 325.)

Specimens examined from Illinois, Wisconsin and adjoining states:

Illinois — Wausaw, Hancock Co., 1; Lake Forest, Lake Co., 2; Fox Lake, Lake Co., 1; Genesee, 1 = 5.

Wisconsin — Camp Douglas, Juneau Co., 1; Milton, 1; Beaver Dam, Dodge Co., 6; Delavan, 1; (M. P. M.) Wauwatosa, 1; Horicon, 1; Reeseville, 1; Milton, 1; Rock Co., 1; Rochester, Racine Co., 33; Saukville, 1; North Lake, Waukesha Co., 1; Honey Creek, Racine Co., 1; Brookville, 1; Wyalusing, Grant Co., 1 = 52.

Minnesota — Fillmore Co., 1.

Iowa — Knoxville, 5.

Indiana — Evansville, 1.

Map illustrating approximate distribution of Fox Squirrels in eastern United States. In the areas indicated by the blank spaces between the ranges given for different races, either or both may occur together with intermediate forms.

Sciurus niger LINN. (Syst. Nat., X ed., I, 1758, p. 64.) Type locality — Probably South Carolina. Largest of the Fox Squirrels; color variable but ears and nose *white*.

Sciurus n. rufiventer (GEOFFROY). Type locality — Probably Lower Mississippi Valley. Somewhat smaller than *niger;* ears and nose never white.

Sciurus n. neglectus (GRAY). (Ann. & Mag. Nat. Hist., 3d ser., XX, 1867, p. 425.) Type locality — Wilmington, Delaware. Averaging somewhat larger than *rufiventer;* belly very pale, often white or whitish.

Sciurus n. texianus (BACHMAN). (Proc. Zoöl. Soc. Lond., 1838, p. 86.) Type locality — Texas. Similar to *rufiventer*, but smaller and paler.

Subgenus **NEOSCIURUS** Trouessart.

Premolars normally $\frac{2-2}{1-1}$; nasals narrowed posteriorly and not extending to posterior end of premaxillaries; zygomata ascending obliquely; molar series relatively large.

Sciurus carolinensis GMELIN.

SOUTHERN GRAY SQUIRREL.

[*Sciurus*] *carolinensis* GMEL., Syst. Nat., I, 1788, p. 148.

Sciurus carolinensis KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 66 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 188 (Iowa). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 6 (Kentucky). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 71 (Missouri). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 361 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 58 (Tennessee, Mississippi, etc.).

Sciurus carolinensis fuliginosus RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 196 (Tennessee).

Type locality — Carolina.

Distribution — Southern half of eastern United States from the edge of the plains, ranging from northern Florida and northern Louisiana north to southern Illinois, southern Indiana and Virginia. Replaced in the North and South by other races.

Description — General appearance grayish, tinged with pale rusty brown on middle of back, on sides behind the fore legs, on ears and about the face and head; under parts white or whitish; soles of feet usually naked; hairs of tail pale tawny brown at base, banded with black and broadly *tipped with white*. Animals of this species *usually* have two premolars on each side of upper jaw.

Measurements — Total length, about 18.25 in. (462 mm.); tail vertebræ, 8.50 in. (215 mm.); hind foot, 2.50 in. (64 mm.).

The Southern Gray Squirrel occurs within our limits in the southern portion of Illinois. The Field Museum collection contains specimens from Olive Branch, Alexander County, but it probably occurs at least as far north as the south central part of the state. As would be expected, specimens from northern Illinois are often more or less intermediate between this form and *S. c. leucotis*, but approach nearer the latter. Its habits are apparently the same as those given for the Northern Gray Squirrel, except that it is less migratory, as would be expected under milder climatic conditions and a consequent less variable food supply.

Specimens examined from Illinois:

Illinois — Olive Branch, Alexander Co., 1; Hancock Co., 1 = 2.

Sciurus carolinensis leucotis (GAPPER).

NORTHERN GRAY SQUIRREL.

Sciurus leucotis GAPPER, Zoöl. Journ., V, 1830, p. 206. SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 119 (Wisconsin).

Sciurus migratorius KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 62 (Illinois, Wisconsin, etc.). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin).

Sciurus niger GODMAN, Amer. Nat. Hist., II, 1826, p. 133.

Sciurus carolinensis MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan).

Sciurus carolinensis leucotis MERRIAM, Mamm. Adirondack Reg., 1886, p. 219. BANGS, Proc. Biol. Soc. Wash., X, 1896, p. 156 (Wisconsin, Minnesota, etc.). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 15 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 364 (Indiana).

Sciurus carolinensis hypophaeus JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 15. *Ib.*, VIII, 1910, p. 86 (Wisconsin).

Sciurus carolinensis var. *leucotis* HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 157 (Minnesota).

Type locality — Region between York and Lake Simcoe, Ontario, Canada.

Distribution — Northeastern United States and southern Canada, from northern Illinois, Indiana and Pennsylvania northward to about latitude 46° and west to Minnesota and Iowa.

Description — In summer: Similar to *carolinensis* but larger and grayer.

In winter: Upper parts silvery gray, the yellowish brown bases of the hairs on the back and head being practically concealed; color subject to much variation. Entirely black specimens are not uncommon in some localities and various intergradations between the black and gray phases of pelage occur.

Measurements — Total length about 20 in. (505 mm.); tail vertebræ 9 in. (230 mm.); hind foot 2.70 in. (69 mm.).

Remarks — The series which I have examined from northern Illinois and Wisconsin seem to confirm Hahn's opinion (*l. c.*, p. 465) that *leucotis* is not separable by color characters from the form recognized as *hypophaeus* from Minnesota. There is no doubt that the Minnesota form *averages* larger and it is not unlikely that it may continue to be given subspecific recognition by some authorities on that account, but that the difference is merely an average one is shown by the fact that selected specimens from eastern New York and other localities, where typical *leucotis* occurs, are fully as large as the largest Minnesota specimens. Under the circumstances, therefore, without further discussing the merits of *hypophaeus* as a subspecies, it would seem best to exclude it from our limits and consider all the Gray Squirrels which occur in Wisconsin to be *leucotis*.

The Northern Gray Squirrel inhabits the more heavily wooded portions of northern Illinois and Wisconsin. Its true home is in groves

Black phase. Normal phase.
Northern Gray Squirrel (*Sciurus carolinensis leucotis*).

of hard wood timber, where it makes its nest both in hollow trees and outside among the branches. When the latter kind is constructed,

it is made of twigs, leaves and bark nicely roofed over with an entrance on the side. These houses, when seen from the ground, have much the appearance of old crows' nests.

In the majority of cases in this latitude two litters of young are born in a year, the first late in March or early in April, and the second usually in September. The young Squirrels number from three to five, rarely six, and when born are entirely without hair.

While this Squirrel cannot be said to hibernate in the strict sense of the word, at least in this latitude, it remains indoors, often for a considerable length of time, during stormy or very severe winter weather; but as soon as the weather moderates and becomes clear, it is out running about as lively as ever.

In localities where they are comparatively numerous their peculiar barking may often be heard; they also make a whining noise difficult to describe. When not persecuted, as in parks or the vicinity of country houses, they soon become very tame, and I have often had them climb up on the bench beside me and take nuts from my hand; usually, however, they would go away a few yards to eat them and then return for more. Dr. C. Hart Merriam states, "Some winters they became very tame, and while we were at breakfast inside, a few used to bring their nuts to the window and eat them there, perched on their haunches on the sill, with their handsome bushy tails cocked over their backs. When any one went out doors they commonly scampered off or ran up a tree, yet several often remained and would allow a near approach without manifesting alarm. They were extremely fond of music (in the most comprehensive sense of the term), and it affected them in a peculiar manner. Some were not only fascinated, but actually spell-bound, by the music-box or guitar. And one particularly weak-minded individual was so unrefined in his taste that if I advanced slowly, whistling '*Just before the Battle, Mother*', in as pathetic a tone as I could muster for the occasion, he would permit me even to stroke his back, sometimes expressing his pleasure by making a low purring sound." (*l. c.*, pp. 223–224.) But a wild Squirrel in the woods is shy, and when observed has a habit of skillfully shifting its position in a tree to keep itself concealed behind trunk or branch, so that the boy with a gun will often have considerable difficulty in discovering the one which he knows to be in a certain tree. Formerly black Squirrels of this species were much more common in localities where now they are apparently rare. While at present the black form seems to be the exception, Kennicott states, "In a lot of nearly fifty shot near the Rock River in Illinois there was not a single gray one, all being of the black variety." (*l. c.*, p. 63.)

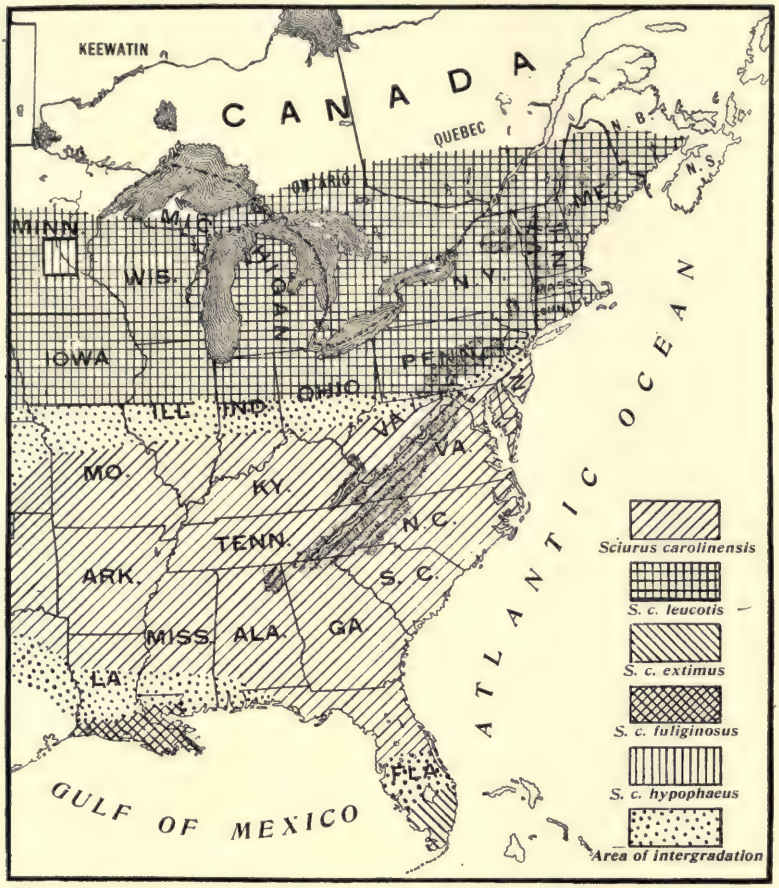
The food of the Gray Squirrel is much the same as that of the Fox Squirrel, and both have the same habit of burying nuts in little holes dug in the ground. While many of these are probably not found again and used by the animal, there is no doubt that a majority of them are, if not by the particular Squirrel that concealed them, by others of his race that have buried nuts in that vicinity. I have on several occasions seen Squirrels bury nuts seemingly in a haphazard way and without any particular regard for the location, the spot selected being wherever it happened to be at the time when it had been given or had found more nuts than it desired to eat. I am inclined to believe that, having a general idea of the location, they trust to their keen sense of smell to enable them to discover their buried treasures when times are not so prosperous. In this connection Dr. C. Hart Merriam says, "Those who have observed the habits of this species in summer must have noticed their propensity for burying nuts just beneath the surface in various parts of the woods. They do not, so far as I am aware, make a great accumulation in any one place, but dig a thousand little holes, plant a nut or two in each, scrape a few leaves over the spot and hurry off as if afraid some one would discover the treasure. In winter this habit is almost equally marked, and the first thing a squirrel thinks of after his hunger is satisfied, is to secrete a portion of the food remaining at his disposal. In accomplishing this he tunnels into the snow in various directions, hiding some of the surplus provisions in each excavation. Many persons who have observed this habit in summer regard it as an idle pastime, and question if the squirrel ever finds the nuts again, knowing that he could never remember the exact position of so many. But those who have kept tame squirrels must have been struck with the remarkable certainty and quickness with which they detect the whereabouts of nuts that are hidden from sight. A squirrel will often scratch and gnaw at a tight box or drawer that he has never seen before, if a few nuts happen to be in the bottom of it. His sense of smell is very acute, enabling him to detect the presence of a nut at some little distance, hence, though he does not, of course, remember the exact spot where each one is buried under the leaves, he can, by moving carefully over the ground, discover a great many of them." (*l. c.*, pp. 224–225.)

While it is probable that Gray Squirrels are migratory at the present time to a more or less extent, their numbers are so greatly reduced as compared with former days that, if they continue the habit, they do not attract attention. Fifty years ago they were known to migrate in vast numbers, not annually but at irregular intervals from some unknown cause, but which may have been governed by food

conditions. Considering the great abundance of these animals in early days, we may well suppose that in poor "nut years" the scarcity of their favorite food would supply a sufficient cause; and assuming scarcity of food to be the dominant factor governing such concerted movements among these animals, the absence of such migrations at the present day may readily be explained on account of the enormous decrease in numbers of Squirrels and consequent abundance of nuts, even in poor years, for those that remain.

Kennicott says, "After one of these grand migrations, very few of the species are found in the localities from which they have moved, and these, as if alarmed at the unusual solitude, are silent and shy. They rapidly increase in numbers, however, and, in a few years, are as abundant as before. I am not aware that they ever migrate except when exceedingly abundant. Of these immense hordes, but few probably survive. No sudden increase in their numbers was heard of in southern Wisconsin after the several migrations from northern Illinois. Many are drowned in attempting to cross streams as has been stated; not a few are destroyed by man; some die from utter exhaustion; and, when forced to travel, in an unnatural manner, upon the ground, they fall an easy prey to rapacious birds and mammals, all of which feast when the squirrels migrate. I learn from Dr. Hoy, that one of these migrations is said to have taken place in southern Wisconsin in 1842; he witnessed another in 1847, and a third in 1852. From these facts, and from observations made in Ohio and elsewhere, he is of the opinion that the migrations, in most cases at least, occur at intervals of five years; and, if he be right, the squirrels, which are now exceedingly abundant again in southern Wisconsin, may be expected to migrate in the autumn of 1857.* He further says that the migrations observed by him in southern Wisconsin occurred when the mast was exceedingly abundant and the squirrels in excellent condition. Near Racine, they were observed passing southward in very large numbers for about two weeks, at the end of September and the beginning of October; and it was a month before all had passed. They moved along leisurely, stopping to feed in the fields, and upon the

* It is interesting to note that Dr. Hoy's prediction that Gray Squirrels would migrate in Wisconsin in 1857 was fulfilled. In a letter to Mr. A. W. Brayton, written at Racine, April 2, 1878, he says, "Black and Gray Squirrels did migrate in 1857 as predicted. Whether there is a precise interval between these migrations I will not pretend to state, yet they did migrate in this section in 1847, 1852 and 1857, since which they have become so scarce that I could not determine whether there was an attempt to migrate or not, as they are nearly exterminated now in this vicinity. In 1857 I knew one negro who stood by a tree, in an open space on the line of a fence, and shot over twenty in one afternoon. In other years one might stand at the same place six months and not see one individual." (Brayton, Geol. Surv. Ohio, IV, 1882, p. 111, foot note.)



Map showing approximate distribution of Gray Squirrels in eastern United States.
In the areas indicated by the dotted spaces between the ranges given for the different races either or both may occur, together with intermediate forms.

Sciurus carolinensis GMEL. Type locality—Carolina. Description as previously given.

Sciurus c. leucotis (GAPPER). Type locality—Region between York and Lake Simcoe, Ontario, Canada. Description as previously given.

Sciurus c. hypophaeus MERRIAM. (Science, VII, 1886, p. 351.) Type locality—Elk River, Minnesota. Supposed to differ from *leucotis* in being somewhat darker, and white on under parts restricted to a narrow central streak on the belly. Minnesota Gray Squirrels average somewhat larger, but the color differences are apparently of little value.

Sciurus c. fuliginosus (BACHMAN). (Proc. Zoöl. Soc. Lond., 1838, p. 97.) Type locality—New Orleans, Louisiana. Larger and darker than *carolinensis;* under parts never pure white, usually washed with ferrugineous.

Sciurus c. extimus BANGS. (Proc. Biol. Soc. Wash., X, 1896, p. 158.) Type locality—Miami, Dade Co., Florida. Smallest of our Gray Squirrels; total length (including tail vertebræ) about 17.50 inches; color lighter and more gray than *carolinensis.*

abundant nuts and acorns of the forests. So far had they departed from their accustomed habits that they were seen on the prairie, four or five miles from any timber; but even there, as usual, they disliked to travel on the ground, and ran along the fences wherever it was possible." (*l. c.*, pp. 64–65.)

Jackson states that in the autumn of 1905 there was a migration of these Squirrels across the Mississippi River from Wisconsin to Minnesota and that later a large number migrated back into Wisconsin. (*l. c.*, p. 87.)

Specimens examined from Illinois and Wisconsin:

Illinois — Lake Forest, Lake Co., 4.

Wisconsin — Camp Douglas, Juneau Co., 1; loc. ?, (albino) 1; (M. P. M). Milton, (black) 1; Delavan, 1; Prescott, Pierce Co., 14; Oconomowoc, 3; Honey Creek, Racine Co., 1; Maiden Rock, 18; Pardeeville, 9; Racine Co., 16; Fall River, Columbia Co., 6; East Troy, 6; Fountain City, Buffalo Co., 8; Waukesha Co., 2; Lancaster, 2. Eagle, (albino) 1; West Bend, (albino) 1; Rochester, 2; Auburndale, (nearly black) 1; (O. C.) Palmyra, Jefferson Co., 5 = 99.

Subgenus **TAMIASCIURUS** Trouessart.

Premolars $\frac{2-2}{1-1}$ or $\frac{1-1}{1-1}$; skull short, broad, and curved, highest between postorbital processes of the frontal; nasals broad; squamosal process of zygoma projecting outward and with gradual downward curve; molar series moderately large.

Sciurus hudsonicus loquax BANGS.

SOUTHERN RED SQUIRREL. RED SQUIRREL. CHICKAREE.

Sciurus hudsonicus loquax BANGS, Proc. Biol. Soc. Wash., X, 1896, p. 161. SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 120 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 128 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 16 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 468 (Indiana). VAN HYNING & PELLETT, Proc. Iowa Acad. Sci., XVII, 1910, p. 214 (Iowa).

Sciurus hudsonius KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 67 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 188 (Iowa).

Sciurus hudsonicus EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 130 (Indiana). ELLIOT, Field Columb. Mus. Pub., Zoöl., I, 1898, p. 219 (Iowa).

Sciurus Hudsonicus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois).

Sciurus Hudsonius THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 656 (Illinois). MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 221 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, 1883, p. 439 (Wisconsin).

Sciurus hudsonicus minnesota ALLEN, Amer. Nat., XXXIII, 1899, p. 640. HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 138.

Type locality — Liberty Hill, New London Co., Connecticut.

Distribution — Eastern United States from the edge of the plains to the Atlantic coast, and from southern Maine, northern Michigan and Minnesota southward; northern Illinois, northern Indiana, Pennsylvania, and in the mountains south to North Carolina. Replaced in the North and Northeast by allied races.

Special characters — General color (in summer) reddish brown; under parts whitish, or grayish white, the hairs not vermiculated. In winter olive grayish on sides, with wide brownish red or rufous stripe down the back; tail flattened; ears with tufts and soles of feet furred in winter.

Description — *In summer:* Upper parts reddish brown; a black stripe on sides separating the red brown color of back from the white on the under parts; under parts white, often tinged in places with rusty; tail largely deep rufous brown; the terminal hairs black near the tip; front of fore legs and upper surface of hind feet clear ferrugineous.

In winter: A broad dorsal band of bright rufous brown extending from between the ears down the middle of the back and along upper surface of tail; sides olive gray; no black stripe on sides or but faintly indicated; under parts grayish white, the hairs plumbeous at the base; under surface of tail olivaceous gray, the hairs on sides and end of tail subterminally marked with black and tipped with tawny.

Measurements — Total length, about 12.50 in. (318 mm.); tail vertebræ, 5.15 in. (130 mm.); hind foot, 1.87 in. (48 mm.).

Remarks — Judging from the material examined, I am inclined to believe the Minnesota Squirrel, *S. h. minnesota*, to be inseparable from *loquax*. The color differences, if any, are inconstant and at most would seem to represent intergradation between true *hudsonicus* and *loquax*. Some Minnesota specimens are larger than any I have seen from Wisconsin or Michigan, and Minnesota specimens average larger, but the difference in size alone is apparently not sufficiently constant nor sufficiently great to warrant subspecific recognition. Be that as it may, specimens from Solon Springs, Douglas County, in extreme northwestern Wisconsin are certainly referable to *loquax*, as are all other Wisconsin and Michigan specimens which I have so far examined.

The following measurements are from specimens in the collection of Field Museum of Natural History:

Beaver Dam, Dodge Co., southeastern Wisconsin:

Total length, 316 mm.; tail vertebræ, 133; hind foot, 50.
" " 331 " ; " " 143; " " 51.

Camp Douglas, Juneau Co., central Wisconsin:

Total length, 325; tail vertebræ, 140; hind foot, 50.
" " 320; " " 138; " " 48.

Solon Springs, Douglas Co., northwestern Wisconsin:

Total length, 315; tail vertebræ, 133; hind foot, 50.
" " 315; " " 128; " " 47.
" " 310; " " 125; " " 48.
" " 310; " " 125; " " 47.
" " 300; " " 120; " " 48.
" " 318; " " 130; " " 47.

Sayner, Vilas Co., northern Wisconsin:

Total length, 312; tail vertebræ, 122; hind foot, 50.
" " 312; " " 123; " " 46.

Fort Snelling, Minnesota, (Topotypes of *S. h. minnesota* collected by E. A. Mearns.):

Total length, 323; tail vertebræ, 137; hind foot, 47.
" " 327; " " 135; " " 49.
" " 327; " " 140; " " 52.
" " 335; " " 142; " " 51.

The following average measurements of 20 topotypes of *S. h. minnesota* are given by Dr. Allen (*l. c.*, p. 641.):

"Total length, 334; tail vertebræ, 130.2; hind foot, 49.2 mm."

The following average measurements of eight adult specimens of *S. h. loquax* from Liberty Hill, Connecticut (the type locality), are given by Mr. Outram Bangs (*l. c.*, p. 161.):

"Total length, 318.3; tail vertebræ, 133.5; hind foot, 47.42 mm."

The Red Squirrel is found in the wooded portions of northern Illinois and is common throughout Wisconsin, frequenting hardwood and mixed groves, as well as coniferous forests, where it can procure pine seeds which in such localities form a considerable portion of its food. Its home is usually in a hollow tree, stump, or log, often an apple tree where, in the majority of cases, a deserted woodpecker's hole is chosen. It has also been known occasionally, though rarely, to make its nest in a hole in the ground. While it does not hibernate in winter, at least in this latitude, it dislikes to go out in stormy weather,

remaining in its snug and well-supplied home; but in clear weather snow and ice have no terrors for it and it may be seen running about

Summer. Winter.
Southern Red Squirrel (*Sciurus hudsonicus loquax*).

on a fine winter day seemingly as lively and contented as in summer. This species occasionally builds an outside nest in the forks of large

branches, which is composed of twigs, leaves and bark; but such nests seem to be the exception in this latitude.

I am satisfied that Red Squirrels pair, at least in Massachusetts, where for many years I had somewhat unusual opportunities for observing them. The young are born in April and vary in number from 4 to 6, although in a majority of cases the number is probably 4 or 5.

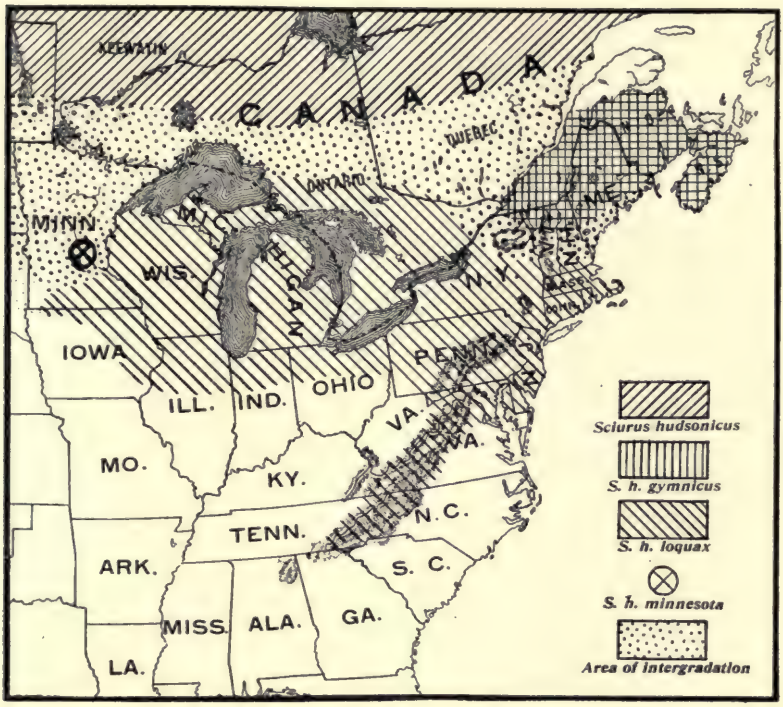
The harsh chattering notes of this species are well known to those who wander in the woods, but it also has several sharp scolding notes, which it usually utters when annoyed by something and thinks itself unobserved.

Kennicott says, "Unlike any other of the true squirrels found here, this species sometimes, but not generally, lives in holes in the ground. Unlike the others, too, it collects into its hole in autumn an ample provision of the good things of squirrel life, wherewith to console and sustain itself in the uncomfortable season of frost and snow. It is well known that the Chickaree makes large hoards of nuts, acorns and seeds. These are deposited in hollow trees, and sometimes under fallen logs, and even in holes in the ground. In consequence of his good cheer, this squirrel is seen actively scampering about in cold weather, when his hungry cousins cannot pluck up courage to leave their warm abodes, even in search of food. In the cornfield, his depredations are at times a source of much annoyance to the farmer. Besides eating at the time with others, this provident species is said to carry off corn to its hole for winter use." (*l. c.*, p. 68.)

The food of the Red Squirrel is very varied and it is practically omnivorous, especially in winter. It is fond of beechnuts and other nuts, acorns, berries, fruit, insects, mushrooms, birds' eggs, young birds, and a variety of other things too numerous to mention.

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — (O.) Lake Forest, 1; Fox Lake, 1 = 2.
Wisconsin — Beaver Dam, 2; Sayner, 2; Solon Springs, 7; Tomahawk Lake, 1; Camp Douglas, 3; Woodruff, 1; Lac Vieux Desert, Vilas Co., 3; (M. P. M.) Rhine, Sheboygan Co., 1; Cataline, 15; Maiden Rock, 7; Conover, 1; Pembine, 1; Milwaukee Co., 1; Washington Island, Door Co., 1; Sheboygan Falls, 1; Golden Lake, Waukesha Co., 1; Rochester, Racine Co., 2; Milwaukee, 1; Merton, 1; Jacksonport, Door Co., 1; Burnett Co., 1; Ellison Bay, Door Co., 1; Muskego Lake, 2; Prairie du Sac, 2; Kelly Brook, Oconto Co., 1; Wauwatosa, 1; (O. C.) Rochester, Racine Co., 1; Pewaukee, 4; Fisher Lake, Iron Co., 13; Langlade Co., 6; Fox Point, Milwaukee Co., 1; Oak Creek, Milwaukee Co., 2 = 88.
Michigan — Park Siding, 6; Murphy Lake, 4; Dowagiac, 5 = 15.

Indiana — La Porte, 1; Bluffton, 1 = 2.
Iowa — Knoxville, 1.
Minnesota — Fort Snelling, 4; Aitken, 1 = 5.



Map illustrating approximate distribution of Red Squirrels in eastern United States.
In the areas indicated by the dotted spaces between the ranges given for the different races, either or both may occur, together with intermediate forms.

Sciurus hudsonicus (ERXLEBEN). (Syst. Regn. Anim., I, 1777, p. 416.) Type locality — Hudson Strait. *In winter:* General color paler than *loquax;* tail with pale tawny or yellowish fringe; under parts finely vermiculated, having a gray appearance. *In summer:* Closely approaching *loquax* but smaller.

Sciurus h. loquax BANGS. Type locality — Liberty Hill, New London Co., Connecticut. Description as previously given.

Sciurus h. gymnicus BANGS. (Proc. New Engl. Zoöl. Club, I, 1899, p. 28.) Type locality — Greenville, Maine. Smallest of eastern races; hind foot short; tail with orange red fringe; under parts grayish in winter.

Sciurus h. minnesota ALLEN. (Amer. Nat., XXXIII, 1899, p. 640.) Type locality — Fort Snelling, Minnesota. Averaging larger than *loquax*, but apparently not separable from it except, perhaps, by size.

Genus **TAMIAS** Illiger.

Tamias Illiger, Prodr. Syst. Mamm. et Avium, 1811, p. 83. Type *Sciurus striatus* Linn.

Size small for a Squirrel, tail less bushy than in *Sciurus;* back conspicuously striped; cheeks with pouches which open between the lips and teeth; postorbital processes slender, pointed (spine-like), and directed obliquely backward and downward; infraorbital foramen small and confined to lower part of maxilla.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{1-1}{1-1}$, M. $\frac{3-3}{3-3}$ = 20.

KEY TO OUR CHIPMUNKS.

A. Back with two pale stripes and several blackish ones; total length (adult) more than 9 inches.

Rump rufous chestnut. Animal occurs from northern Illinois southward. CHIPMUNK, *Tamias striatus*, p. 128.

Rump more cinnamon brown, general pelage grayer. Animal occurs in northern Illinois and Wisconsin. GRAY CHIPMUNK. *Tamias s. griseus*, p. 130.

B. Back with four pale stripes and several dark ones; size small, usually less than 9 inches. Animal occurs in northern Wisconsin. LITTLE CHIPMUNK. *Eutamias borealis neglectus*, p. 135.

Tamias striatus (LINN.).

CHIPMUNK. STRIPED CHIPMUNK. SOUTHERN CHIPMUNK.

[*Sciurus*] *striatus* LINNÆUS, Syst. Nat., X ed., I, 1758, p. 64.

Tamias striatus KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 70 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 189 (Iowa). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 6 (Kentucky). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 129 (Indiana). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 193 (Tennessee). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 471 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 59 (Kentucky, Tennessee, Mississippi, etc.). *Ib.*, XXIII, 1910, p. 25 (Illinois, Missouri, etc.).

Tamias striatus lysteri MCATEE, Proc. Biol. Soc. Wash., XX, 1907, p. 3 (Indiana).

Type locality — Southeastern United States.

Distribution — On Atlantic coast from southern New York and New Jersey to North Carolina, westward through southern Indiana and southern Illinois to eastern Kansas, southward to northern South Carolina, northern Georgia and Tennessee.

Special characters — Tail only moderately bushy and rather flat; back striped; rump rufous chestnut. Its smaller size and rufous chestnut rump will distinguish it from its more northern race, *T. s. griseus*, but intermediates must be expected in northern Illinois.

Striped Chipmunk (*Tamias striatus*.

Description — Back with five black stripes; the central black stripe bordered by two brownish stripes and a stripe of tawny white on each side of the back separating the two outer black stripes; rest of upper parts rusty brown, with a slight mixture of grayish brown shading into tawny brown on the cheeks and sides, and *deep chestnut rufous on the rump* and flanks; under parts white or whitish; tail rufous, edged with black.

Measurements — Total length, about 9.75 in. (245 mm.); tail vertebræ, 3.75 in. (95 mm.); hind foot, 1.25 in. (31.8 mm.).

The Southern Chipmunk occurs within our limits in southern Illinois. Howell records it from Olive Branch, Wolf Lake, Woodlawn and Olney, and I have seen a specimen taken in Macon County, in the central portion of the state. Its habits are similar to those of the northern race, *Tamias striatus griseus*.

Tamias striatus griseus MEARNS.

GRAY CHIPMUNK. GRAY STRIPED CHIPMUNK.

Tamias striatus griseus MEARNS, Bull. Amer. Mus. Nat. Hist., III, 1891, p. 231. SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 115 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 17 (Wisconsin). *Ib.*, VIII, 1910, p. 87 (Wisconsin). MILLER, Proc. Bost. Soc. Nat. Hist., XXVI, 1897, p. 30 (Nepigon and Peninsular Harbor, Ontario).

Tamias lysteri KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois).

Sciurus striatus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).

Tamias striatus MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Michigan). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 160 (Minnesota). ELLIOT, Field Columb. Mus. Pub., Zoöl., I, 1898, p. 219 (Iowa).

Tamias striatus lysteri ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 128 (Michigan).

Type locality — Fort Snelling, Hennepin Co., Minnesota.

Distribution — From northern Illinois and Iowa northward throughout Wisconsin, Minnesota and Michigan, and in Canada to about latitude 49°. Specimens from extreme northern Indiana are nearer this form than *striatus*.

Description — Similar to *T. striatus* but larger and more gray; rump more cinnamon brown, not rufous chestnut as in *striatus;* spaces between black stripes on back distinctly grayish; flanks tawny brown; under surface of tail paler and tail hairs tipped with gray.

Measurements — Total length, 9.75 to 11.55 in. (247 to 288 mm.); tail vertebræ, 3.30 to 3.95 in. (84 to 108 mm.); hind foot, 1.42 to 1.50 in. (36.5 to 38 mm.). Average of 30 specimens from northern

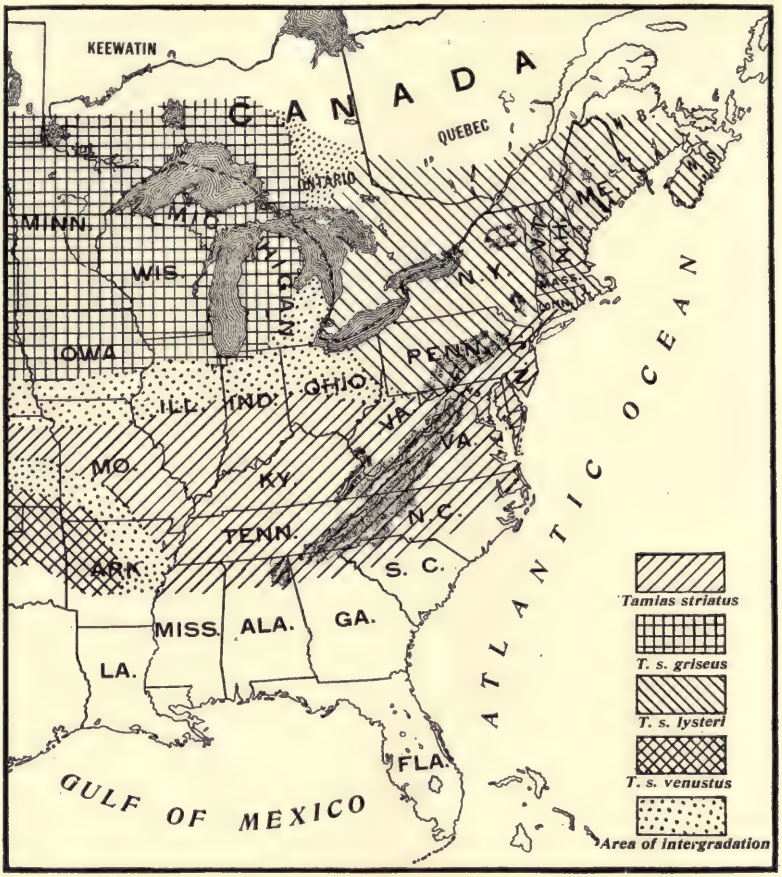
Illinois and Wisconsin: Total length, 271.5; tail vertebræ, 94.5; hind foot, 37.5 mm.

Wooded localities, where underbrush abounds, about loose stone walls and old logs, or in the vicinity of outbuildings, where there is sufficient growth for concealment, is the chosen home of the Chipmunk. It passes most of its life on the ground and in climbing about fallen logs, fences and rocks, although it occasionally climbs large trees. It is very active and industrious, and during the summer devotes a great deal of its time to storing up food for winter use in its home, which is usually a hole beneath a wall or old stump or an underground burrow. While I am satisfied that it hibernates in winter, at least in this latitude, its sleep is apparently not very profound and the length of time it remains indoors depends largely upon the severity of the weather. During a warm spell it occasionally ventures forth for an airing even in midwinter, but as a rule it seeks its winter home shortly after the first hard frost and is rarely seen again until late in February or March. If undisturbed in the vicinity of dwellings, it soon becomes tame, and, if watched, may often be seen hurrying away with its cheek pouches distended with nuts or other food which it deposits in its storehouse and shortly returns with empty cheeks ready for another load. When suspicious of possible danger, but not actually frightened, it often sits upright and repeatedly utters its sharp "chip," accompanying each vocal effort by a slight twitch of its tail.

While Chipmunks prefer nuts, acorns, seeds and grains for their winter use, they eat almost anything, including small snakes, young mice, birds' eggs and young birds when they can get them, as I know from personal experience, having caught one in the act of attacking a nest containing half fledged young robins. Mr. E. T. Seton quotes a letter from Mr. William Brewster, the well-known Cambridge naturalist, who says, "While collecting at Crooked Lake, Michigan, in May, 1888, I shot at a wood thrush and broke its wing. As it fluttered over the ground a Chipmunk pursued and caught it. When I reached the spot the Chipmunk had killed the bird and eaten most of its brains. I had to kick at the Chipmunk to make it give up the thrush. Afterward as I held the bird dangling in my hand the Chipmunk approached and jumped up, trying to snatch it from me." *

The young are usually 4 or 5, and when born are without hair and the eyes are closed. Kennicott says, "The quantity of nuts, acorns and seeds sometimes collected by these industrious little fellows is astonishing. They are frequently stored temporarily under logs, and in shallow holes under roots of trees, and afterwards removed to the

* Life Histories of Northern Animals, I, 1909, p. 355.



Map illustrating approximate distribution of Chipmunks (belonging to the genus *Tamias*) in eastern United States.

In the dotted areas between the ranges given for the different races either or both may occur, together with intermediate forms.

Tamias striatus (LINN.). Type locality — Southeastern United States. Description as previously given.

Tamias s. griseus MEARNS. Type locality — Hennepin Co., Minnesota. Description as previously given.

Tamias s. lysteri (RICHARDSON). (Fauna Bor. Amer., I, 1829, p. 181.) Type locality — Penetanguishene, Georgian Bay, Ontario, Canada. Paler and somewhat longer than *striatus;* rump and thighs yellowish red.

Tamias s. venustus BANGS. (Proc. Biol. Soc. Wash., X, 1896, p. 137.) Type locality — Stilwell, Boston Mountains, Indian Territory. Size about the same as *griseus*, but colors brighter and back stripes much shortened.

burrow, at a more leisure season. I have known lazy people to watch the chipmunks in nutting time, and finding where they carried their stores, dig them out, saying they could thus get nuts faster than by picking them up themselves. In a burrow dug open in November, I found over half a bushel of hickory-nuts and acorns. These were not all in one place, but in four or five enlarged chambers, in different parts of the burrow, which was complicated, and consisted of several winding and intersecting passages, situated not over a foot below the surface. The entrance to the burrow was under a log, and the passages extended several feet on every side. A large nest of leaves and grass was placed above the surface, under the rotten log. Only one of the inhabitants was found but he was quite active.

"This ground squirrel is sociable; and sometimes, though not always, several pairs occupy the same burrow in winter, the store of food being common property. These, like the true squirrels, stand erect on their hind-feet, when eating, using the fore paws as hands. The power of their incisors is wonderful; they cut with apparent ease through the shells of the seeds of the wild plums, which would resist the point of tempered steel.

"At times, the note of the chipmunk is a short deep *cluck*, repeated ly pronounced, without variation; and on a sunny day, he will sometimes utter it for an hour at a time, being meanwhile perched upon a stump or log; but more frequently the note is a shriller *chip-chip*. When alarmed, he utters a low chatter." *

Specimens examined from Illinois, Wisconsin and adjoining states:

Illinois — Fox Lake, Lake Co., 13.

Wisconsin — Tomahawk Lake, 4; Camp Douglas, 2; Woodruff, 1; Beaver Dam, 14; Spread Eagle, 2; Lac Vieux Desert (Vilas Co.), 1; (M. P. M.) Keesus Lake, 2; Sumpter, Sauk Co., 1; Milwaukee Co., 2; Newport, Door Co., 1; Busseyville, 1; Oconomowoc, 1; Kelley Brook, Oconto Co., 3; Prescott, 6; Milwaukee Co., 2; Maiden Rock, 10; (O. C.) Nashotah, 2; Milwaukee Co., 5; Fisher Lake, Iron Co., 1 = 61.

Indiana — La Porte, 1.

Michigan — Murphy Lake, 1; Park Siding, 2 = 3.

Minnesota — Fort Snelling, 4.

Iowa — Cedar Rapids, Linn Co., 1; (Coe College collection) Cedar Rapids, 1 = 2.

* Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 72.

Little Chipmunk (*Eutamias borealis neglectus*).
Gray Striped Chipmunk (*Tamias striatus griseus*).

Genus **EUTAMIAS** Trouessart.

Eutamias Trouessart, Catal. Mamm. Viv. et Foss., Bull. Soc. Études Angers, X, 1880, p. 86. Type *Sciurus striatus asiaticus* Gmelin.

The members of this genus differ from those belonging to *Tamias* in being smaller, the back stripes narrower and closer, and the tail relatively longer; there are also two additional premolars.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3} = 22$.

Eutamias borealis neglectus (ALLEN).

LITTLE CHIPMUNK.

Tamias quadrivittatus neglectus ALLEN, Bull. Amer. Mus. Nat. Hist., III, 1890, p. 106. MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 31 (North Bay and north shore of Lake Superior, Ontario).

Tamias asiaticus var. *quadrivittatus* HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 162 (Minnesota).

Tamias quadrivittatus STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 440 (Wisconsin). BARRETT, Amer. Nat., VII, 1873, p. 695.

Eutamias quadrivittatus neglectus JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 17 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 128 (Michigan). SETON, Life Histories of Northern Animals, I, 1909, p. 364.

Eutamias borealis neglectus HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 139 (Wisconsin).

Type locality — Eastern shore of Lake Superior, Ontario, Canada.

Distribution — Ranges from northern Wisconsin, northern Michigan and central Minnesota northward into Canada, throughout the greater part of Ontario and Keewatin to about latitude 55°; replaced from Manitoba and North Dakota westward by *Eutamias borealis*.

Special characters — Smaller than the common Chipmunk, and stripes narrower, tail relatively longer; cheek stripes *whitish*.

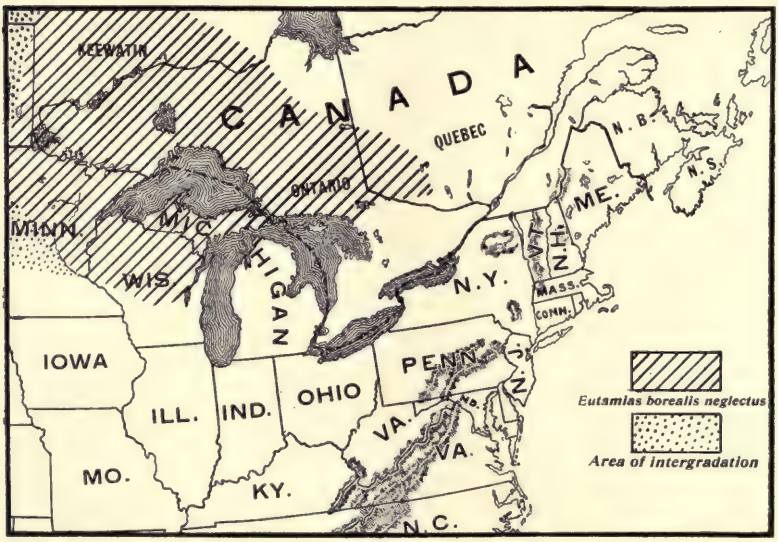
Description — A whitish stripe above and below the eye; back with five black stripes and four pale stripes, the outer pale stripes being distinctly whitish, the inner pale ones grayish; the middle black stripe extends from between the eyes to base of tail; sides of body orange brown or tawny; hairs on under parts tipped with white but plumbeous at base, giving a grayish white appearance to the fur; tail pale rufous brown, the hairs subterminally marked with black and tipped with pale rufous brown or tawny brown.

Measurements — Total length, about 8.50 in. (216 mm.); tail vertebræ, 3.75 in. (91 mm.); hind foot, 1.25 in. (31.8 mm.). Extremes of 20

specimens: Total length, 208 to 230; tail vertebræ, 84 to 96; hind foot, 31 to 32 mm.

The Little Chipmunk is common in northern and central Wisconsin at least as far south as Juneau County,* but does not occur in southern Wisconsin or Illinois. It is easily distinguished from the larger Chipmunk by its small size and narrower and more conspicuous stripes. Its most common note is a sharp "chip," somewhat resembling that of the larger species, but higher in pitch and more shrill. When frightened it often utters a shrill whistle. Its habits appear to be much the same as those of its larger relative, *Tamias striatus griseus*. There is no doubt that this species hibernates in winter but it does not retire to its winter home until quite late in the season, and its sleep is not so prolonged as that of some of its relatives. Mr. Ernest T. Seton writes, "In August and September the little Chipmunk emulates its cousin in labouring for the rainy days to come. As late as September 26 at Fort Resolution I saw one carrying home great bulging pouchfuls of skunk-grass seeds. About the end of the month, it finally plugs its doorway against the cold, the wet and the Least Weasel, and curls up for its six months' sleep." (*l. c.*, p. 371.)

Mr. Gerrit S. Miller found this species very abundant on the north



Map showing approximate range of the Little Chipmunk (*Eutamias borealis neglectus*); replaced from the Dakotas westward by *Eutamias borealis;* no other representative of this genus occurs in eastern United States.

* The Field Museum collection contains 8 specimens of this subspecies from Camp Douglas, Juneau County, Wisconsin.

shore of Lake Superior. He writes, "Although it is universally distributed outside of thick woods at Nepigon and Peninsula, the little chipmunk shows a marked preference for open rocky hillsides, while the big chipmunk prefers the edge of the forests, where stumps and logs furnish it a more congenial shelter. . . . While *T. striatus* on the north shore of Lake Superior hibernates near the end of September, immediately after the first heavy frosts, *T. quadrivittatus* remains active much later — probably until the snow cuts off its food supply. The small chipmunk was actively running about in the light snow during the second week of October, 1896, although the temperature during the day averaged about 15° F. On October 23, I found an adult female in a nest built of feathers and soft vegetable fibers at the end of a tunnel under a clump of bearberry. The tunnel was about two feet long and terminated a foot or more beneath the surface in a chamber about the size of a cocoanut. The chamber was completely filled by the nest, which contained, in addition to its occupant, a small store of seeds of various weeds and wild fruits." (*l. c.*, p. 31.)

Specimens examined from Wisconsin and adjoining states:

Wisconsin — Camp Douglas, Juneau Co., 8; Lac Vieux Desert, Vilas Co., 7; Conover, 1; (M. P. M.) St. Croix Dam, Douglas Co., 5; Pembine, 1; Divide, Vilas Co., 1; Marinette, 10; Upper St. Croix Lake, 5; Yellow River, Burnett Co., 5; Mouth Namekagan River, 1; Cataline, 3; Kelly Brook, Oconto Co., 5; (O. C.) Fisher Lake, Iron Co., 2 = 48.

Michigan — Park Siding, 12; Sevey, 1 = 13.

SUBFAMILY MARMOTINÆ.

Genus **CITELLUS** Oken.

Citellus Oken, Lehrb. der Naturg., Zool., II, 1816, p. 842. Type *Mus citellus* Linn.

Form squirrel-like, but tail less bushy; color pattern variable; cheek pouches developed; hind feet with five developed toes; front feet with four developed toes and a rudimentary thumb. Skull relatively heavier than that of *Sciurus;* postorbital processes slender and spine-like; upper premolars two, the first much smaller than second; anteorbital foramen round or oval with tubercle on outer lower edge. Two species belonging to this genus occur in Illinois and Wisconsin.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3} = 22$.

Subgenus **ICTIDOMYS** Allen.

"Ears generally small, sometimes rudimentary; tail long, cylindrical, or narrow and flattened, or quite broad, with the hairs one-half to three-fourths the length of the body; skull very long and narrow; first upper premolar usually rather small and the dentition not heavy" (Allen).

KEY TO OUR SPECIES.

Back with stripes and rounded spots.
STRIPED PRAIRIE SQUIRREL. *Citellus tridecemlineatus*, p. 138.
Back not striped, general color grayish tinged with brown; hairs vermiculated with blackish. FRANKLIN'S PRAIRIE SQUIRREL. *Citellus franklini*, p. 144.

Citellus tridecemlineatus (MITCHILL).

STRIPED PRAIRIE SQUIRREL. STRIPED SPERMOPHILE. STRIPED GOPHER. THIRTEEN-LINED GROUND SQUIRREL. STRIPED GROUND SQUIRREL.

Sciurus tridecem-lineatus MITCHILL, Med. Repos., N. S., VI, 1821, p. 248.

Spermophilus tridecimlineatus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 74 (Illinois).

Spermophilus tridecem-lineatus MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 189 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 440 (Wisconsin).

Spermophilus tridecemlineatus OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 165 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 128 (Indiana). BAILEY, U. S. Dept. Agr., Bull. No. 4, Ornith. & Mamm., 1893, p. 31. HOY, Agr. Rept. for 1853, U. S. Patent Office Rept., II, 1854, p. 68 (Wisconsin and northern Illinois).

Citellus tridecemlineatus JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 18 (Wisconsin). *Ib.*, VIII, 1910, p. 87 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 475 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 524 (Illinois).

Type locality — Central Minnesota.

Distribution — From southern Illinois and northern Missouri to northwestern Ohio, southern Michigan and central Wisconsin, extending west and northwest to edge of the Great Plains and the Saskatchewan Region; replaced in western Missouri by an allied form, *C. t. badius*.

Description — Somewhat squirrel-like in appearance, but tail comparatively short and not bushy; back with alternating stripes of whitish and dark brown, the latter with *central row of rounded whitish spots;* under parts very pale tawny brown; middle of tail mixed brown and white, like colors of the back, bordered by an inner

Striped Prairie Squirrel (*Citellus tridecemlineatus*).

stripe of black, the ends of the hairs forming the fringe buffy white; a pale ring around the eye.

Measurements — Total length, 10.75 in. (273 mm.); tail vertebræ, 4 in. (101 mm.); hind foot, 1.37 in. (35 mm.).

The Striped Prairie Squirrel, Striped Gopher, or Thirteen-lined Spermophile, as it has been variously called, is common in the prairie regions, and large open fields nearly throughout Illinois and in southern Wisconsin, and scattered colonies are occasionally found further north. Jackson records it from the vicinity of Iron River, Bayfield County, in the extreme northern part of the state. It is diurnal and gregarious, and during the summer months its tremulous whistle is often to be heard and the little animal seen sitting upright or running rapidly through the grass, but rarely far from its burrow.

It has a bad reputation among farmers, which is not altogether undeserved, on account of the habit of pulling up and eating newly planted corn and other grains and seeds; but, on the other hand, it must be given credit for destroying great quantities of beetles, caterpillars, grasshoppers and other injurious insects. It must be admitted, however, that it cannot be considered of benefit to the agriculturist. Mr. Vernon Bailey says, "Undoubtedly the good which the Striped Spermophiles do by destroying insects and seeds of noxious weeds is of no small importance; but it is doubtful if it is sufficient to offset the damage perpetrated by them in the grain fields. In many localities it is impossible to raise a full field of corn without first killing the spermophiles. As soon as the corn is planted they begin to dig up the seed, but do most mischief after the corn begins to come up and until a week or ten days old, or until all the nutriment is drawn from the grain. They dig down by the side of the stalk and eat the swollen, starchy grain, of which they seem very fond, leaving the stalks to die. As a single spermophile will dig up many hills of corn in a day and continue digging for nearly two weeks, it is not difficult to see that serious damage is done where they are numerous, averaging as they often do four or five to an acre. Large fields of corn are sometimes entirely destroyed by them and have to be planted over several times. A great deal of wheat, oats, barley and rye is taken in the same way, making it necessary to sow an extra amount of seed. Even this means is not effectual and frequently fields of sowed grain suffer materially from their attacks. As the small grains begin to fill, soon after blossoming, the spermophiles cut down the stalks and eat the ovules, and in order to find the best heads they cut down a great deal more than they can eat. As the grain becomes hard they carry large stores of it into their burrows to be eaten at leisure, probably when they awake from their winter's sleep.

The amount of damage done depends upon the abundance of the animals and is often serious. If the field is small and isolated, the spermophiles sometimes collect and destroy almost the whole crop." (*l. c.*, p. 42.)

Concerning the habits of this species in Illinois, Kennicott says: "Before the production of the young in May or June the old male leaves the female, and appears to lead a solitary and more or less wandering life, digging a temporary burrow, or occupying a deserted one for a few days, wherever he may take up his abode. These summer burrows may often be found, and sometimes are of considerable extent; several of those which were examined were more than 20 feet in length, being simple galleries from six inches to a foot below the surface — deeper in sandy soil — opening at both ends, with the nest placed in a small side chamber; others were of much less extent, sometimes with but one entrance, and sometimes without nests. The winter burrow, in which the pair hibernate and the female brings forth her young, is deeper and more complicated, having always two entrances, or more. In this, in a side chamber of suitable size, excavated above the level of the rest of the burrow, is a large spherical nest of soft grass, entered by an opening on one side. This nest is sometimes of the size of a half bushel, the interior being generally lined with softer material than the outside. The young are produced at the end of May or early in June. I have observed from five to nine brought forth at a birth and I am informed of two instances in which ten were found in a nest; but the number is variable, the usual number being six or seven. The young at birth are naked, blind and remarkably embryonic. Dr. Hoy, who observed them in confinement, says that they have no hair on the body before they are twenty days old and that the eyes do not open until the thirtieth day. They continue to require the nourishment and care of the mother for a much longer period than most rodents. During the summer they begin to dig shallow burrows and leave her before winter, to shift for themselves." (*l. c.*, pp. 76–77.)

This species hibernates during the winter. At the approach of cold weather it retires into its burrow and remains there in a torpid state for several months, or until the return of mild weather in the spring. In northern Illinois it generally goes into winter quarters late in October and reappears again about the first of April. On March 27, 1910, I saw two at Burnside near Chicago, and on March 28 and 29, 1911, several were seen running about in the same locality. On both occasions the weather for several days had been unusually warm for the season.

Hibernation — Hibernation is a term applied by zoölogists to express a peculiar condition of torpid sleep in certain animals, which

is not thoroughly understood. Its marked characteristics are abnormally low bodily temperature with nearly suspended respiration; heart action much reduced with consequent slowing of the circulation. Animation is suspended to a degree resembling death and the apparently dead animal soon becomes actually so, if taken from its hole and exposed for any length of time to a temperature a few degrees below that of freezing. This strange physiological condition enables certain animals, which without some such provision of nature would otherwise perish from lack of food, to pass the winter sleeping in their holes or burrows in latitudes where the ground is frozen and covered with snow and ice for several months in the year.

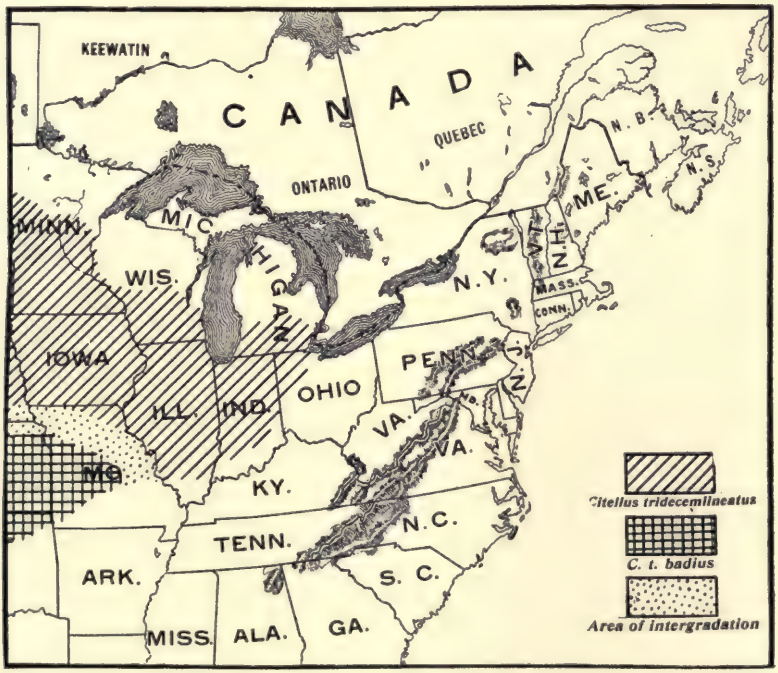
Regarding the hibernating of the Striped Gopher or Prairie Squirrel, Kennicott writes, "At the approach of severe cold, in autumn, the prairie squirrel retires to its burrow, entrances to which are tightly closed with earth to exclude the frost. In the large nest of grass he curls himself up, with his head against the abdomen, and falls into a state of torpor, out of which he does not awaken until the return of warm weather in spring. In this state, he takes no nourishment whatever, nor does he move.

"If cut or bruised he exhibits no signs of feeling; and to all external appearances seems dead. Respiration and the circulation of the blood are carried on very imperfectly; but slight oxygenation of the blood takes place, and little heat is generated — the body being cold. There is no secretion or excretion, and very little waste of tissue occurs, and thus the necessity of food is obviated. From this state he is at once revived to activity by the simple application of heat. Placed in the cold he again becomes torpid. It is to be observed that the species, which passes the winter thus in profound torpor, if removed to a warm climate, or if kept in a warm room, will remain active during winter. Thus we see how, in the perfect laws of Nature, it is ordained that hibernating animals shall fall into this state of torpor only when they would suffer from cold and want of food, if active."* (*l. c.*, pp. 73-74).

Concerning the condition of this animal during hibernation, the report of Dr. P. R. Hoy is of interest. He writes, "During activity the gopher's pulse is 200, respiration 50, temperature 105. . . . On the 15th of December, the gopher being thoroughly torpid, temperature of the room 45, gopher rolled up like a ball, no visible evidence of life, I opened the abdomen and inserted the bulb of a thermometer which indicated 58°. I next turned back the sternum

* In this connection it should be stated that the Florida Black Bear, *Ursus floridanus*, continues to hibernate without regard to temperature and at a time when "palmetto berries" (*Serenoa serrulata*), its favorite food, are abundant.

in such a manner as to expose the heart and lungs. The remarkably congested condition of these organs first attracted my attention; in fact, it would appear as if all the blood had collected within the thorax. The pulsation of the heart was reduced to four each minute; the auricles would slowly and imperfectly contract, followed immediately by the ventricles. These slow pulsations of the heart occupied four seconds, there was no visible respiration, the lungs remaining almost entirely passive. The heart continued to pulsate, without perceptable change, for fifteen minutes, and then when raised from its position it continued to pulsate for some time, being almost reptilian in this aspect. During hibernation the circulation is so feeble that when a limb is amputated but few drops of blood will slowly ooze from the fresh wound. The stomachs and bowels empty, and the body was enclosed in a thick adipose layer. I was not able to



Map illustrating approximate distribution of Striped Prairie Squirrels in eastern United States. Several other forms occur in the West.

Citellus tridecemlineatus (MITCHILL). Type locality — Central Minnesota. Description as previously given.

Citellus t. badius (BANGS). (Proc. New Engl. Zoöl. Club, I, 1899, p. 1.) Type locality — Stotesbury, Vernon Co., Missouri. Similar to *tridecemlineatus*, but larger and more red brown on the tail.

excite the least motion or contraction of the muscles in any way, even by pinching or cutting nerves, showing the most perfect condition of anæsthesia possible. During hibernation the gopher is not able to endure more than 6° or 8° of frost. The manifestations of life are so feebly performed that a few degrees below freezing is sufficient to convert apparent death into the reality." (Proc. Am. Assoc. Adv. Sci., Aug., 1875, pp. 148–149.)

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Chicago, 30; Fox Lake, 2 = 32.
Wisconsin — Beaver Dam, 14; (M. P. M.) Delavan (albino), 1; Cataline, 3; Maiden Rock, 4; Mouth Yellow River, Burnett Co., 3; Milwaukee Co., 4; Muskego Lake, 2; Lindwurm, Niles Co., 1; Upper St. Croix Lake, 11; Prescott, 16; Fountain City, 1; Genoa, Vernon Co., 2 = 52.
Iowa — Luxemburg, 1.
Minnesota — Fort Snelling, 3.

Citellus franklini (SABINE).

FRANKLIN'S PRAIRIE SQUIRREL.
GRAY PRAIRIE SQUIRREL. GRAY GROUND SQUIRREL. GRAY GOPHER. FRANKLIN'S GROUND SQUIRREL. FRANKLIN'S SPERMOPHILE.

Arctomys franklinii SABINE, Trans. Linn. Soc., XIII, 1822, p. 587.
Spermophilus grammurus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).
Spermophilus Franklinii KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 440 (Wisconsin). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1871, p. 189 (Iowa).
Spermophilus franklinii KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 79 (Illinois).
Spermophilus franklini COUES & ALLEN, Monog. N. Amer. Rodentia, 1877, pp. 884–885 (Illinois, Wisconsin, Minnesota, etc.). OSBORN, Proc. Iowa. Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). HERRICK, Geol. & Nat. Hist. Sur. Minn., Bull. No. 7, 1892, p. 166 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 129 (Indiana). BAILEY, U. S. Dept. Agr., Bull. No. 4, Ornith. & Mamm., 1893, p. 48 (Wisconsin, Illinois, Minnesota, Dakota, etc.). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 115 (Wisconsin).
Citellus franklini JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 18 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 139 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 478 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 528 (Illinois).

Type locality — Cumberland House, Saskatchewan, Canada.
Distribution — From the Saskatchewan Region southeast over the Red River and Mississippi valleys to eastern Nebraska and Kansas to central Missouri, extending eastward as far as northwestern

Indiana. Includes within its range the whole of Iowa, northern Missouri, northern two-thirds of Illinois, a small portion of northwestern Indiana, southern and western Wisconsin and at least the southern and western half of Minnesota. An isolated colony occurs in the vicinity of Tuckerton, New Jersey, which has descended from a pair introduced there in 1867.* It has also been introduced near Georgian Bay, Ontario.†

Description — Adult: Upper parts (except head and tail) grayish brown or pale tawny brown, the hairs vermiculated with blackish; a buffy white ring around the eye; top and sides of head blackish, faintly speckled with white; under parts buffy white or tawny white; terminal two-thirds of tail grayish, the hairs banded with black and tipped with white.

Immature: The tawny tinge much less pronounced and the back with irregular bars of black.

Measurements — Total length, 15 in. (380 mm.); tail vertebræ, 4.75 in. (120.6 mm.); hind foot, 1.88 in. (47.6 mm.).

Remarks — This species has a superficial resemblance to a Gray Squirrel and might be mistaken for one by those not familiar with mammals. The tail, however, is much shorter and less bushy (tail always less than 6½ inches), the body color is more tinged with tawny, and the ears are much shorter.

Franklin's Prairie Squirrel, Franklin's Spermophile or "Gray Gopher", as it is variously called, occurs in various localities throughout southern and western Wisconsin and at least the northern two-thirds of Illinois, although more local in distribution and less common than the preceding species. Jackson considers them quite common in Wisconsin west from Rock County to the Mississippi River and north to Pepin County. He states he has taken specimens in Rock County and has observed the species in Green, Sauk and Jefferson counties (*l. c.*, p. 18). Hollister gives it as common in isolated colonies in various parts of Walworth County and says, "I have collected many specimens near Delavan. The largest colonies here are located on Ridge Prairie just west of the town, and on the border of Big Marsh, seven miles north of Delavan on the Whitewater road. The Biological Survey has records of this species from Janesville, Kansasville, Madison, Plover, Racine, Ripon and Whitewater" (*l. c.*, p. 139). It is apparently not uncommon in Dodge County, as Mr. W. E. Snyder has collected a number of specimens near Beaver Dam. In Illinois it is found in scattered communities throughout the greater portion of the central

* Allen, Monog. N. Amer. Rodentia, 1877, p. 833.

† Seton, Life Histories of Northern Animals, I, 1909, p. 374.

Franklin's Prairie Squirrel (*Citellus franklini*).

and northern portion of the state. There are numerous records for the interior, and in northern Illinois it has been taken in Cook and Carroll counties, and Mr. B. T. Gault writes me he secured a fine albino specimen near Glen Ellyn in the fall of 1909. He considers the species rather rare, however, in that locality. There are specimens in this Museum from western Illinois taken in the vicinity of Warsaw, Hancock County, and the Northwestern University collection in Evanston contains two specimens from Kane County.

The southern limit of its range in Illinois is given by Bailey as St. Clair County ("O'Fallon Depot," *l. c.*, p. 49). He says, "In but few places are they as common as the smaller Striped Spermophile (*S. tridecemlineatus*), though the two species range together over a wide area. Their habits are quite similar and it is often difficult to distinguish the voice of one from that of the other. The note of Franklin's Spermophile is somewhat heavier and has a slightly different ring, but is the same shrill, rapid chipper or trill. It is sharp and ringing and may be heard for a considerable distance" (*l. c.*, p. 51).

In describing the habits of this species in Illinois, Kennicott says, "It is far less numerous here than the striped spermophile, and appears to be a less abundant species wherever the two exist. It is observed to inhabit the thickets of low bushes, and the edges of the timber, more than the other, but does not occur in the woods. It is fond of digging long burrows in the banks of ditches, and several times I have seen it living in steep river banks, as well as under small wooden culverts in roads. It is not so shy as the striped spermophile, and takes up its residence quite near dwellings. It is also less disturbed by the cultivation of land. In this region it is usually found living alone or in pairs, and I have never observed a number of burrows scattered over a small prairie knoll like the semi-villages of the striped spermophile. This is perhaps owing to their small numbers; for the species appears to be naturally gregarious, and, at times, large companies live together, burrowing within a few feet of each other, and several pairs even entering the same hole.

"This spermophile exhibits a remarkable disposition to migrate from one field to another. Not only do the males lead a wandering life in summer, but pairs appear frequently to change their quarters, leaving their winter burrow to breed in another, and then, perhaps, hibernating in a third, at some distance from this. In several instances, a company of a dozen or more have been observed to appear in a locality where none were seen the previous summer, and then to disappear after remaining there a year, or only a few weeks. In the early part of summer, twenty or thirty of these animals suddenly

made their appearance, and burrowed in an old embankment, within three or four rods of my father's house. They seemed to have lost the shyness exhibited when leading a solitary life, and were not alarmed at the near approach of man. They even came about the kitchen door to pick up crumbs and disputed with the chickens for their food. Like the striped spermophiles, they glided silently to their burrows when alarmed, uttering, as they entered, a remarkably clear whistle twitter, more musical than the voice of any other mammal I ever listened to, and as clear as that of a bird. The same note was uttered when the animal was hurt or much frightened. They fed upon June-grass, clover, timothy, and the broad-leaved plantain, and seemed particularly fond of the leaves of the common mustard, of which some plants grew near their burrows. Other specimens examined in summer had their stomachs filled with grass alone. In eating they sat bolt upright on the tarsi, and used their fore-feet as hands, to draw the leaves to their mouths, though their paws were used thus with less facility than those of the true squirrels. Though both the vegetable and flower gardens were situated within five rods of their burrows, I do not remember that they were observed to injure either. A number of young chickens disappearing, however, and the eggs being eaten in several hens' nests near the burrows of the spermophiles, suspicion rested upon them — probably unjustly — and a war of extermination was commenced. Several were shot, while others were killed with clubs, whereupon the survivors left in a body, as suddenly as they had come, and were never seen again, nor could they be found upon any part of the farm. I have known this spermophile to take refuge in a hollow tree, crowding up the hole like the grey-rabbit. Mr. F. C. Sherman, of Chicago, informs me that he twice saw one, when pursued, climb five or six feet up the trellis-work and vines at the side of the house.

"The burrow of this species is usually deeper than that of the striped spermophile, but otherwise similar to it. The young I have not observed, but Mr. George S. Parker of Pecatonica, Illinois, writes me that he once saw five, and at another time seven young in a nest. They appear to go into winter-quarters in the fall, and re-appear in the spring, at about the same time as the striped spermophile. They have been found hibernating under piles of rails, and in corn-shocks; and I am informed of two instances in which one has been found torpid in a hay-stack, where he had formed a burrow in the hay. I have never heard of its hibernating in such situations. A caged specimen of Franklin's spermophile, kept by Professor Baird, of the Smithsonian Institution, was active all winter; and Dr. A. M. P. Hughes, of Payson,

Illinois, informs me that he found one in a burrow under a corn-shock, active in mild weather, late in November.

"This species is carnivorous, though apparently less so than the striped spermophile. The specimen kept by Professor Baird was decidedly carnivorous, but one observed by Dr. Hoy did not eat mice, though it killed them when placed in its cage. Its food is generally similar to that of the striped spermophile, stores being also found in its burrow" (*l. c.*, pp. 79–81).

Mr. Vernon Bailey gives the following list of the various kinds of food found in the stomachs of 29 animals of this species: "Beetles, large and small species (Coleoptera), Larvæ of beetles (Coleoptera), Caterpillars (larvæ of Lepidoptera), Grasshoppers and Crickets (Orthoptera), Ants, Eggs of insects, Chrysalis, Feathers of small bird, Spermophile hair (probably their own), Grain (wheat and oats), Seeds of basswood (*Tilia*), Strawberries, *Solanum* berries, Herbage (stems and leaves of plants, among which only an *Equisetum* could be recognized), Roots" (*l. c.*, p. 55).

Specimens examined from Illinois and Wisconsin:

Illinois — Warsaw, 1.

Wisconsin — (M. P. M.) Delavan, 3; (S. C.) Beaver Dam, Dodge Co., 10 = 13.

Map illustrating approximate eastern range of Franklin's Prairie Squirrel (*Citellus franklini*).

Cynomys ludovicianus (ORD), PRAIRIE DOG. Thomas includes this species in his list of Illinois Mammals (*l. c.*, p. 657.) but it is probably an error, as the eastern limits of the range of this species is much farther west, it being rarely found east of the Missouri River.*

Genus **MARMOTA** Blum.

Marmota Blumenbach, Handb. der Naturg., I, 1779, p. 79.

Size large, weight 8 to 10 pounds, but more often less; general color grizzly brown or grayish brown, without stripes; skull broad and depressed; post-orbital processes long and pointed; first premolar nearly as large as second; infraorbital foramen confined to lower part of maxillary; edges of auditory meatus somewhat protruding; tail comparatively short (5 to 6 inches) and thickly haired; front feet with four developed toes and a rudimentary thumb; hind feet with five toes. Six species and two subspecies are recognized in North America, but only one species and one subspecies occur within our limits.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3} = 22$.

KEY TO OUR SPECIES.

A. Larger, with less rusty brown on under parts. Occurs in Illinois and Wisconsin. WOODCHUCK. *Marmota monax*, p. 150.

B. Smaller, with more rusty brown on under parts. Occurs in extreme northern Wisconsin. CANADA WOODCHUCK. *Marmota monax canadensis*, p. 157.

Marmota monax (LINN.).

WOODCHUCK. GROUND HOG.

[*Mus*] *monax* LINNÆUS, Syst. Nat., X ed., I, 1758, p. 60.

Arctomys monax LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 82 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 190 (Iowa). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 440 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 168 (Minnesota). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 6 (Kentucky). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 193 (Tennessee). MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 26 (Milton, Ontario). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 128 (Indiana). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 120 (Wisconsin).

* Pellett records it from Cass County, southwestern Iowa. (Proc. Iowa Acad. Sci., 1910, p. 214.)

Marmota monax ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 128 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 19 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 480 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 25 (southern Illinois, Missouri, Kentucky).

Type locality — Maryland.

Distribution — From the edge of the Plains to the Atlantic, north to about the Canadian border except in northern Maine, northern New Hampshire and northern Vermont; south to Virginia, Kentucky, central Missouri and Kansas, and in the Allegheny Mountains in Tennessee. Replaced in Canada by a smaller and browner form, *M. m. canadensis*.

Description — Adult: General color grizzly brown, the hairs on the back being largely tawny brown with gray tips and blackish bases; belly and under parts more tawny brown, shading to rusty brown around the fore legs; feet brownish black; cheeks grayish; mouth edged with more or less whitish; tail dark brown, many of the hairs tipped with gray. The general color is variable, some being much darker than others and occasionally black or pure white specimens occur. Two fine examples of the latter are contained in the Field Museum collection.

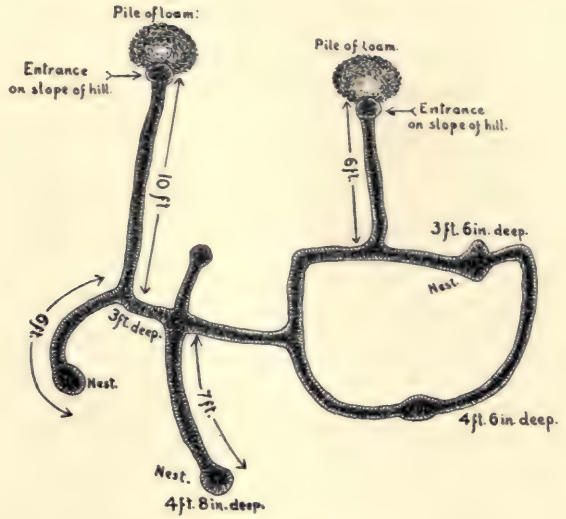
Measurements — Total length, 22 to 25 inches; tail vertebræ, 5.25 to 6.15 inches; hind foot, 3.40 to 3.75 inches.

Average measurement of eight specimens from various localities: Total length, 23.25 in. (579.8 mm.); tail vertebræ, 5.60 in. (142 mm.); hind foot, 3.60 in. (90.4 mm.).

Remarks — Specimens from northern Wisconsin are intermediate between *monax* and *canadensis*, and those from the extreme northern part of the state, while not typical *canadensis*, approach much nearer to that form than to *monax*.

The Woodchuck, or Ground Hog as it is often called, is common throughout Illinois and Wisconsin. At the present time in settled districts it frequents open fields in preference to woods (which is its natural habitat), where it lives in burrows in the ground. These burrows vary in form and extent; some are not uncommonly 50 feet in length, while others will not exceed 10 feet or even less. They are rarely more than 5 feet in depth below the surface of the ground at the deepest point. I once found a nest at the end of a burrow which was 5 feet 3 inches below the surface of the ground, but the average depth will probably not exceed 4 feet. Usually each burrow is provided with at least two entrances and often with three, including a "back door." The following sketch illustrates the plan of a burrow of a large Woodchuck in an alfalfa field at Lake Geneva, Wisconsin.

Woodchuck (*Marmota monax*).



Plan of a Woodchuck Burrow.

Mr. W. H. Fisher of Cincinnati, Ohio, has published an interesting paper on the burrows of this animal.* He examined 9 burrows: the longest was 47 feet 11.50 inches (for all the galleries) and the shortest was 6 feet 8.50 inches; the greatest depth (measured from the surface) was 49 inches. Some burrows had three entrances, a few only one, but the majority had two.

Each burrow is generally inhabited by a pair of Woodchucks, although occasionally by a single old male. The young are born in their underground home late in April or early in May and usually number from four to six, but occasionally as many as 8 are found in a litter. They are very small and blind at birth and do not come out of the hole until they are four or five weeks old and the weather becomes quite warm.

Regarding the habits of this animal Kennicott says, "In this part of Illinois it was exceedingly rare ten years ago, but is now becoming quite common. It is an inhabitant of the woods, where it occupies the place that the spermophiles do on the prairies; and though it burrows in open fields, and in the timber, I am not aware that it ever lives on the prairie, though I have seen it in prairie groves. In the East, it inhabits open fields in preference to deep woods. This love for open ground is probably acquired. Here I have most commonly observed it in the heaviest timber, and it is said to be found most abundantly in Missouri . . . It is very watchful, and, when feeding, will frequently stand erect, with neck stretched as high as possible, and look

* Journ. Cincinnati Soc. Nat. Hist., XVI, 1893, pp. 105–123, pls. 6–10.

suspiciously about. . . . Only a single pair of adults occupy the same burrow. The hibernation of the woodchuck is as profound as that of the spermophiles. Naturally this animal is strictly herbivorous. Though living in the woods, it does not eat nuts, nor gnaw bark, nor am I aware that it ever digs roots. It is not a tree climber, though it sometimes crawls up a leaning tree, or into the thick branches of bushes overgrown with vines, on which it is fond of lying in warm sunny days. In this vicinity I have often found a number of them taking refuge in standing hollow trees, entering a hole at the ground, and climbing up the cavity in the manner of the gray rabbit." (*l. c.*, p. 83.)

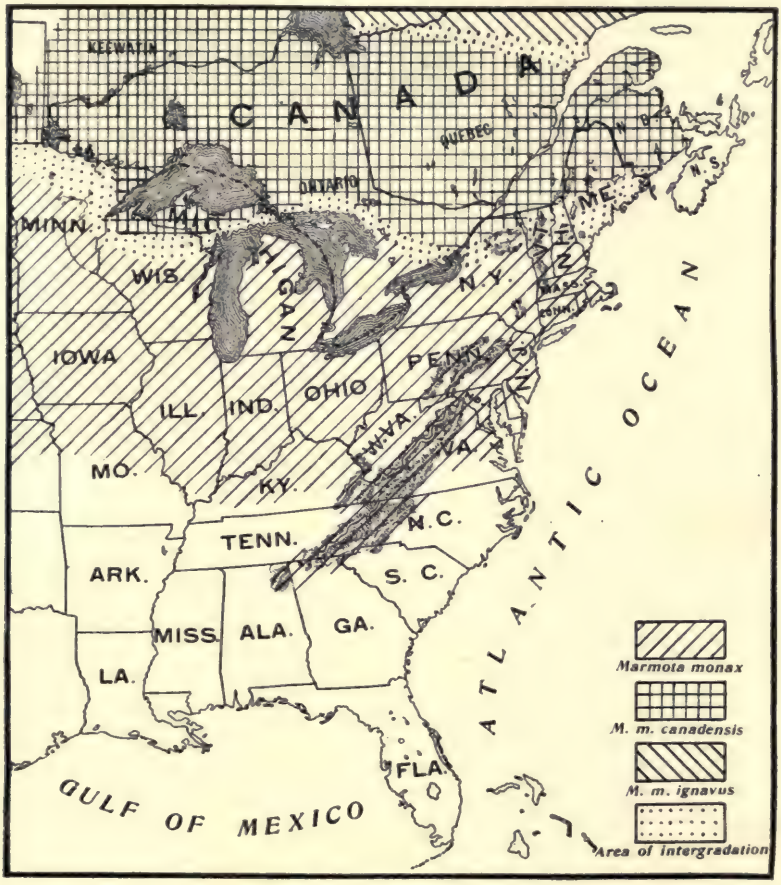
Woodchucks do not store up food in their burrow for winter use, as they hibernate during the cold months. Regarding this strange condition of suspended animation Dr. C. Hart Merriam writes,* "In hibernation the temperature of the animal approximates that of the surrounding atmosphere, the heart action slackens and respiration can only be detected by means of delicate instruments devised for the purpose. This fact was known to Spallanzani nearly a hundred years ago, for he wrote to Senebier, 'You will remember about my Marmot which was so exceedingly lethargic in the severe winter of 1795; during that time I held him in carbonic acid gas for four hours, the thermometer marking $-12°$; he continued to live in this gas which is the most deadly of all . . . at least, a rat and a bird that I placed with him perished in an instant.'"

The following account of the habits of a tame Woodchuck is given by Audubon and Bachman†, as related to them by the Hon. Daniel Wadsworth of Hartford, Connecticut. "'I kept,' said he to us, 'a fine Woodchuck in captivity, in this house for upwards of two years. It was brought to me by a country lad, and was then large, rather wild, and somewhat cross and mischievous; being placed in the kitchen, it soon found a retreat, in which it remained concealed the greater part of the time every day. During several nights it attempted to escape by gnawing the door and window sills; gradually it became more quiet, and suffered itself to be approached by the inmates of the kitchen, these being the cook, a fine dog, and a cat; so that ere many months had elapsed, it would lie on the floor near the fire, in company with the dog and would take food from the hand of the cook. I now began to take a particular interest in its welfare, and had a large box made for its use, and filled with hay, to which it became habituated and always returned when inclined to repose. Winter coming on, the box was placed in a warm corner, and the Woodchuck went into it, arranged its

* Mamm. Adirondack Reg., 1886, p. 243.

† Quadrupeds N. Amer., I, 1854, pp. 20–21.

bed with care, and became torpid. Some six weeks having passed without its appearing, or having received any food, I had it taken out of the box, and brought into the parlour: it was inanimate and as round as a ball, its nose being buried as it were in the lower part of its abdomen, and covered by its tail; it was rolled over the carpet many times; but



Map illustrating approximate distribution of Woodchucks in eastern United States.

Marmota monax (LINN.). Type locality — Maryland. Description as previously given.

Marmota m. canadensis (ERXLEBEN). Type locality — Hudson Bay. Smaller than *monax* and general coloration decidedly more reddish brown; brownish black of crown extending below the eye.

Marmota m. ignavus (BANGS). (Proc. New Engl. Zoöl. Club, I, 1899, p. 13.) Type locality — Black Bay, Straits of Belle Isle, Labrador. Size about like *canadensis* but general color darker and skull shorter and broader.

without effecting any apparent change in its lethargic condition; and being desirous to push the experiment as far as in my power, I laid it close to the fire, and having ordered my dog to lie down by it, placed the Woodchuck in the dog's lap. In about half an hour my pet unrolled itself, raised its nose from the carpet, looked around for a few minutes, and then slowly crawled away from the dog, moving about the room as if in search of its own bed! I took it up and had it carried down stairs and placed again in its box, where it went to sleep, as soundly as ever, until spring made its appearance. That season advancing, and the trees showing their leaves, the Woodchuck became as brisk and gentle as could be desired, and was frequently brought into the parlour. The succeeding winter this animal evinced the same disposition and never appeared to suffer by its long sleep.'"

Woodchucks are vegetarians. Their food consists principally of grasses and clover, although, when near a garden, they will eat cabbages, beans, pumpkin vines, young corn, etc., and often do considerable damage. They feed regularly morning and evening, but often come out any time during the day and on moonlight nights. While as a rule they are shy and suspicious, they can fight well, when cornered, as many a dog has learned to his cost. The flesh is very palatable when properly prepared; the fur is little used, but the skin, when properly tanned, makes an excellent soft leather.

There is a popular superstition that on the second day of February the Woodchuck comes out of his hole and looks about. If he sees his shadow, it is a sign that the weather will continue cold for some time to come and there will be a late spring; but if, on the other hand, he fails to see his shadow, then there will be an early spring and little or no cold weather. The reason for this ridiculous superstition can only be surmised, as its origin is obscure.

Specimens examined from Illinois, Wisconsin and adjoining states:

Illinois — Lake Forest, 1; Willow Springs, 1; Fox Lake, 3; (O.) Lake Forest, 2 = 7.

Wisconsin — (M. P. M.) Waukesha, 1; Lake Koshkonong, 1; Prescott, Pierce Co., 3; Newport, Door Co. (not typical), 2; Maiden Rock, Pierce Co., 1; Waukesha Co., 1; (O. C.) Turtle Lake, Barron Co. (skulls), 4; Waukesha Co., 4; (O.) Lake Geneva, 4 = 21.

Marmota monax canadensis (ERX.).

CANADA WOODCHUCK.

[*Glis*] *canadensis* ERXLEBEN, Syst. Regni Anim., I, 1777, p. 363.
Arctomys monax canadensis ALLEN, Bull. Amer. Mus. Nat. Hist., XI, 1898, p. 456.

Type locality — Hudson Bay.

Distribution — Ranging from northern Wisconsin and northern New England, northward to Hudson Bay and west in Canada to about longitude 120° and latitude 60°. Intergrades in northern Wisconsin with *monax*.

Description — (Specimen from Murray Bay, Province of Quebec, Canada.) General appearance of *M. monax*, but smaller and coloration of under parts decidedly more rusty brown; whole crown brownish black, brownish black of crown including the eye and extending considerably below it; rest of upper parts grizzly, the hairs being broadly tipped with gray. The tawny under fur on the back usually has a very slight rufous brown tinge, under parts rusty brown or red brown; muzzle pale; feet black; tail brownish black mixed with brown hairs.

Measurements — Total length, about 20.25 in. (515 mm.); tail vertebræ, about 4.25 in. (108 mm.); hind foot, 3 in. (74 mm.).

Remarks — Woodchucks from extreme northern Wisconsin, while not typical *canadensis*, approach much nearer to that form than to *monax*. A specimen taken by Mr. W. H. Osgood at Conover, Vilas Co., Wisconsin, August 11, 1910, has the whole crown brownish black and the rusty coloration of the under parts closely approaching *canadensis*. Its measurements are as follows: (No. 18392, ♂) Total length, 526 mm.; tail vertebræ, 137 mm.; hind foot, 69 mm. An adult male, killed at Minagua, Vilas Co., measured: Total length, 520 mm.; tail vertebræ, 125 mm.; hind foot, 70 mm.

Specimens examined:

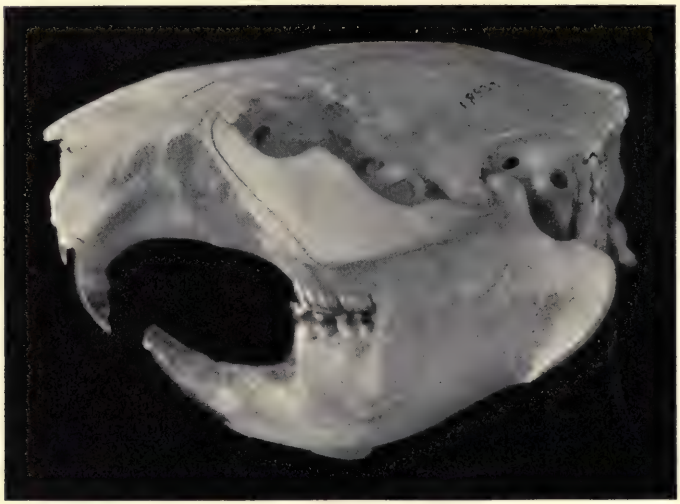
Wisconsin — Conover, Vilas Co., 1; (O. C.) Mercer, Iron Co. (skull), 1; Langlade Co., (skulls), 2; (O.) Minagua, Vilas Co., 1 = 5.

Minnesota — Aitken, (melanistic), 1.

Canada — Murray Bay, Province of Quebec, 4.

Family CASTORIDÆ. Beavers.

Tail broad and flat (paddle shaped), hairless and covered with scales; hind feet broadly webbed; skull stout; incisors noticeably large and strong. The general character of the skull is sciurine, but postorbital processes are absent and the infraorbital foramen is nearly concealed by a large nearly vertical ridge of the maxilla; the auditory meatus is



Skull of a Beaver. (About ⅔ nat. size.)

long and tubular and extends upward above level of the zygoma; lower leg bones separate; five toes on both fore and hind feet; second toe of hind foot with double or divided claw.

The family consists of but one genus, *Castor*, represented in North America by one species and five geographical races. They are large, aquatic Rodents, the largest living representatives of the order in North America, often weighing 40 or 50 pounds, and are much hunted and trapped for their skins, which are one of the best known commercial furs. The anal glands of the Beaver contain a strong scented, oily fluid known as "Castoreum," which is much used by trappers as a bait to attract the animal. It is also used more or less in the manufacture of perfumes, and is claimed to possess medicinal properties.

The only other living representative of this family is the European Beaver (*C. fiber*), which is very similar to our species; it differs in being somewhat smaller, the skull is comparatively lighter, and the nasal bones are longer.

Genus **CASTOR** Linn.

Castor Linnæus, Syst. Nat., X ed., I, 1758, p. 58. Type *Castor fiber* Linn. Characters as given for the family.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{1-1}{1-1}$, M. $\frac{3-3}{3-3}$ = 20.

Castor canadensis KUHL.

BEAVER. CANADIAN BEAVER.

Castor canadensis KUHL, Beitr. z. Zool., 1820, p. 64. OSBORN, Annals of Iowa, 3rd ser., VI, No. 8, 1905, p. 566 (Iowa). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 19 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 139 (Wisconsin).

Castor fiber KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). LAPHAM, Trans. Wis. State Agr. Soc., 1852 (1853), p. 339 (Wisconsin). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 190 (Iowa). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). HERRICK, Geol. & Nat. Hist. Surv. Min., Bull. No. 7, 1892, p. 170 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 128 (Indiana).

Castor Canadensis THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 657 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Michigan). HOY, Trans. Wis. Acad. Sci. Arts & Letters, V, 1882, p. 256 (Wisconsin). WOOD, Bull. Ill. State Lab. Nat Hist., VIII, 1910, p. 536 (Illinois).

Type locality — Hudson Bay.

Distribution — North America, from about latitude 40° northward to Labrador and Hudson Bay region and in the western portion of its range to the Arctic Circle; replaced in the South and extreme West, about longitude 120°, by slightly different geographical races.

Description — General color brown; the hairs on upper parts dark brown at base, tipped with lighter brown or chestnut; under parts paler than the back; sides of neck and rump light cinnamon brown; tail flat and rounded (paddle shaped), black, and covered with scales; claw on second toe of hind foot double or divided.

Measurements — Total length, about 42 in. (1068 mm.); tail, 16.25 in. (410 mm.); hind foot, 6.75 in. (175 mm.). The bare, scaly part of the tail measures about 9 inches long, 4.50 inches wide, and 1.50 inches in thickness in the middle.

Beavers were formerly common throughout Illinois and Wisconsin, but at the present time they are practically exterminated in the former state. Unfortunately we do not know precisely what form occurred in southern Illinois and lack of material for examination ren-

Canadian Beaver (*Castor canadensis*).

ders it entirely a matter of conjecture. It would seem likely, however, from geographical reasons that Beaver from southern Illinois would probably show intergradation between *canadensis* and the southern race, *C. c. carolinensis*, and, perhaps, approach nearer the latter than to the typical form.

Probably no other animal has been more intimately connected with the early history and settlement of this country than the Beaver. This fine animal, the largest of our North American Rodents, possesses a commercially valuable skin with a more or less edible body, the tail at least being considered a delicacy by many people; and it is not surprising that after so many years of persecution both by Indians and white trappers, it has been exterminated throughout a large portion of its former range. It is still common, however, in some parts of the United States and in Canada, and where it has of late years received Governmental protection its numbers are on the increase.

The enormous number of these animals which have been trapped and otherwise killed is suggested by the fact that during the years 1860 and 1870 the number of skins received by the American Fur Company and Hudson Bay Company averaged 153,000 per annum* and, of course, an immense number of these animals were killed by white trappers and Indians, the skins of which did not find their way to either of the companies mentioned. Later the number decreased somewhat, but even at the present time the number of Beavers annually killed in the United States and Canada will probably exceed 75,000.

During the early part of last century Beaver skins were a recognized basis of barter between the trappers (at that time largely Indians) and the fur companies, a blanket or rifle being valued at so many "skins," always meaning Beaver skins. That the rate of exchange was profitable to the fur companies is evident from the statement of Mr. Robert Brown, who says, "When beaver were 30 s. per pound, Rocky Mountain beaver were piled up on each side of a trade gun until they were on a level with the muzzle, and this was the price! The muskets cost in England some 15s." (Proc. Linn. Soc. London, Zoöl., 1868 (1869), pp. 369–70.)

In early days Beavers were common along the wooded streams throughout Illinois and Wisconsin, but at the present time they are practically exterminated in Illinois, although it is probable that a very few individuals may exist in the extreme southern portion of the state. Mr. B. T. Gault of Glen Ellyn, Illinois, wrote me that in the year 1900 he saw some Beaver cuttings near Thebes, Alexander County, in southern Illinois and enclosed a letter from Mr. C. J. Boyd of Anna,

* Seton, E. T. Life Histories of Northern Animals, I, 1909, p. 451.

Illinois, dated April 7, 1910, who writes, "From the best information I can get, there are a few Beaver in Alexander County." There are but few records of even comparatively recent date for Illinois. Thomas records a specimen killed in Jackson Co., in 1851 (*l. c.*, p. 657). Evermann and Butler state that a Beaver was seen swimming in the Wabash River about 12 miles above Lafayette, Indiana, in the summer of 1889 (*l. c.*, p. 128). According to early writers, however, they were common in suitable localities throughout the state in the early part of the last century. Woods (1820–21) says, "To the north of us [English Prairie, Illinois] there are buffalo and elks, also beavers and others on the rivers." * We also find in the records of Long's expedition the following statement, "Deer, turkeys and beaver are still found in plenty in the low grounds along both sides of the Mississippi" † [two miles north of the confluence of the Ohio and Mississippi]. In 1854 Kennicott writes, "The remains of beaver dams exist in several streams" [Cook Co.]. (*l. c.*, p. 579.) Mr. G. E. Wood states, "The beaver seems to have been practically exterminated in this part of the state [Champaign Co.] before the first permanent settlers came. There was an extensive dam on the South Fork a few miles above Urbana, and several others less generally known, on the lower part of the Salt Fork." (*l. c.*, p. 536.)

In Wisconsin they are still to be found in more or less numbers in most of the northern counties, although for many years they have been exterminated in the southern part of the state. Lapham states that "The last Beaver killed, in the southern part of Wisconsin, was in 1819, on Sugar Creek, Walworth County, a very large one." (*l. c.*, p. 339, foot note.) Several colonies are known in Marinette, Forest, Iron and a number of other counties in northern Wisconsin. Mr. W. J. Webster of Park Falls writes me (1909) that there are "quite a number of Beaver in Price Co." According to Mr. N. Lucins, Jr., of Solon Springs, in 1909 there was a large family of Beavers on the Moose River in Douglas County. It is reported to occur in Wisconsin at least as far south as Buffalo County. Mr. J. Hobbs of Medford, Taylor Co., informs me that there are a number of Beaver in Taylor Co., and that he knows where there are "a few Beaver dams with Beavers in them." Mr. George F. Erzwein of Athens, who is an experienced trapper, informs me they are still to be found in Marathon Co.

In northern Michigan Beaver were at one time very numerous, and it was in the Michigan peninsula south of Lake Superior that Mr.

* Woods, J. Two Years' Residence in the Settlement on English Prairie in the Illinois Country, 1820–1821 (1822), p. 290.

† James, E. Expedition from Pittsburgh to the Rocky Mountains, 1819–1820 (1823), p. 42.

Beaver Dam and House. (From a sketch by Leon L. Pray.)

Lewis H. Morgan secured a large amount of information upon which his valuable work on the Beaver* was based. A few years ago they were nearly exterminated in that locality, but owing to wise protection their numbers are again increasing. At the present time there are a considerable number of beaver inhabiting the rivers and lakes near Champion, Michigan. Several of their dams and houses may be seen near White Deer Lake, and the presence of the animals is shown by the numerous fresh "cuttings" along the banks.

An adult male Beaver of average size will weigh from 30 to 45 pounds, but it is claimed they often grow considerably larger. Audubon and Bachman mention one weighing 61 pounds, and an animal weighing 68 pounds is recorded by Mr. Ernest Thompson Seton.†

Quiet streams and ponds bordered by poplars or quaking aspens and willows are the favorite haunts of these animals; often a shallow brook with sufficiently high banks is chosen for the site of their home. The locality being selected, a pair of Beaver at once begin work to build a dam and thereby make a pond of sufficient depth and suitable for the use of themselves and their family; meadows are often flooded in this manner until a pond is made having a depth of at least 3 or 4 feet. The dam is built of branches laid one on top of the other, the several ends pointing up stream and fastened down with mud and rocks; occasionally a fallen tree or drifting log is made use of, but large logs are the exception. The height of the dam varies, commonly ranging from 4 to 6 feet, but Morgan describes one "about 35 feet long, 12 feet in vertical height, and with a slope of interlaced poles on its lower face upwards of 20 feet in length" (*l. c.*, p. 119). The length of the dam depends, of course, on the location and the size of the stream, or pond; there are numerous records of dams 500 feet or more in length and there is one in Beaver Lake, Yellowstone Park, which is estimated by General S. B. Young to be about 700 feet.‡

In building the dams and houses the Beaver uses his forepaws, like hands, to carry the mud and stones used in their construction. The branches are dragged to where they are needed, one end being held in the teeth. Occasionally several dams are made one below the other, thus reducing the pressure on the one highest up stream. When the dam is finished to their satisfaction, they decide on a location for their home. In some instances, where the banks are suitable, they dig burrows, but in others they construct dome-shaped houses in the ponds. In all cases the entrance to their houses is under water with

* The American Beaver and his Works, Philadelphia, 1868.

† Life Histories of Northern Animals, 1909, p. 448.

‡ Seton, E. T. Life Histories of Northern Animals, I, 1909, p. 457.

a passage leading to a good-sized chamber, the floor of which is several inches above the level of the water. When houses are built, they are constructed of sticks, brush and mud; the top is rounded and rises three or four feet above the water. Ordinary houses vary in size from 6 to 14 feet in diameter, although some are considerably larger. The living chamber of an ordinary house is often (but not always) nearly circular and has a diameter of from 4 to 5 feet and a height of from 15 to 24 inches; the size varies considerably and there are many smaller and others decidedly larger. These chambers are almost invariably supplied with two entrances. When the house is in a bank, the length of the passageway to the living rooms varies, but is commonly from 10 to 20 feet.

In swimming the Beaver propels itself by its broadly webbed hind feet and makes little or no use of the forefeet, which are usually held loosely against the body. They have a habit of striking the water with their tails before diving, making a loud splash, the sound of which on a calm evening can be heard a long distance. While as a rule they strike the water before diving, they do not always do so, as I have, on at least two occasions, seen them dive silently after the manner of a Muskrat. Their work is done chiefly in the evening and at night, although in unsettled districts they may not uncommonly be seen swimming about in the daytime. The young are usually born in May and the average number in a litter is 4 or 5, sometimes 6 and, according to Morgan, very rarely 7 or 8 (*l. c.*, p. 221). The extraordinary number of 10 young Beavers in a litter is recorded by Brown.*

The food of the Beaver consists principally of the bark and tender twigs of the poplar or aspen and the willow. It also eats the bark of other trees and bushes and sometimes roots and leaves. To procure its store of winter food it cuts down trees and transports the logs and branches to the vicinity of its house or burrow, where they are stored under water to be used when needed. In many cases a hole in the ice is kept open to enable the animals to come out when they please, and through which an extra supply of food can be taken to the house after the river or pond is frozen over. Numbers of small trees are cut down, but larger ones having a diameter of 12 to 15 inches are by no means unusual. Trees two feet in diameter are occasionally felled by these animals and Lewis and Clark record one measuring nearly three feet.† In places where the trees are separated from the water by a marsh, the Beavers dig canals to enable them to float the trees and larger branches, after they are cut up into sections, to the pond. The larger

* Brown, R. Proc. Linn. Soc. Lond., Zoölogy, 1868 (1869), p. 367.

† Lewis and Clark, Ex. Longman's ed., p. 146.

Hole in the ice cut and kept open by Beavers near Champion, Michigan.
(From photograph by W. H. Osgood.)

A Beaver House near Champion, Michigan.

Trees cut down by Beavers near Champion, Michigan.

pieces are pushed and rolled into these canals often by several Beavers working together and using their shoulders and bodies as well as their teeth and paws in their efforts. Some of the canals are of extraordinary length. Morgan found several more than 500 feet long, one of which was situated on the Carp River, Michigan,* and which he describes as follows:

"There is an extensive canal on Carp River a short distance below the bend . . . It runs through low, swampy ground, which is covered for one-quarter of its length with a thicket of alder so dense that it was difficult to follow the channel for the purpose of measurement. The river, which at this point is a hundred feet wide, more or less, is bordered with alder and cranberry bushes, and with a forest of tamaracks. Back of these, some six hundred feet, is the first rising ground covered with deciduous trees, to reach which the canal was constructed. At the distance of one hundred and eleven feet from its commencement in the river there was a rise in the surface level of about a foot, which made necessary either a dam or an additional foot of excavation to furnish sufficient depth of water. A dam twenty-five feet long across the canal and the grounds adjacent, was the expedient adopted. The second level of the canal, thus raised a foot above the first, continued one hundred and seventy-eight feet, where a second rise occurred of about the same amount, and where a second dam was constructed thirty feet long. As the ground on both sides of the canal was swampy, with water in pools here and there, it was only necessary to excavate a channel of requisite depth to obtain a sufficient supply of water by filtration from the adjoining lands. Up to the first dam the canal was filled from the river, and consequently varied in depth with the rise and fall of the stream; but above this, where it depended upon the dam and the source of supply before named, it was uniformly about 18 inches deep. From the second dam the canal continued at a foot higher level for the distance of two hundred and ninety feet, where it terminated at the base of the hard wood lands at a distance of five hundred and seventy-nine feet from the river. Its average width was about four feet, and it had an unobstructed channel of about eighteen inches deep from one end to the other, with the exception of the dams. The runways of the beavers over these dams were very conspicuous. They were shown, as in the other cases, by a depression in the center formed by travelling over them in going up and down the canal. At the mouth of the canal the river was not deep enough for a beaver to swim below its surface out into the stream. To obviate the difficulty, a

* Southwest of Teal Lake, about 15 miles west of Marquette and less than 50 miles from the Wisconsin line.

channel twenty-five feet long and a foot or more wide was excavated in the bed of the river far enough out to carry them into deep water. The materials were thrown up in an embankment on the side below the excavation, apparently lest the currents of the stream should carry them back into the channel. The excavation and the embankment, which were plainly to be seen side by side, the latter in places coming to the surface of the water, presented another striking illustration of

Map illustrating approximate former distribution of Beaver in eastern United States.

Castor canadensis KUHL. Type locality — Hudson Bay. Description as previously given.

Castor c. carolinensis RHOADS. (Trans. Amer. Philos. Soc., N. Ser., XIX, 1898, p. 420.) Type locality — Dan River near Danbury, Stokes Co., North Carolina. Very similar to *canadensis*, but somewhat larger and the tail broader.

Castor c. texensis BAILEY. (N. Amer. Fauna, No. 25, 1905, p. 122.) Type locality — Cummings Creek, Colorado County, Texas. General coloration paler and tail narrower.

the industry as well as the intelligence of the beaver" (*l. c.*, pp. 199–200)

In felling the larger trees the Beaver first cut two parallel grooves, or furrows, at right angles with the grain and about two or three inches apart and the wood between these furrows is split out with their sharp chisel-like teeth; the operation is then repeated to a greater depth and continued until the tree falls. The cut portion of the tree resembles the middle of an hour-glass and both ends of the severed part are conical.

Much has been written of the wonderful sagacity shown by Beaver in their work, and while a great deal which is claimed for them is true, in some cases at least over-zealous and non-scientific observers have been prone to draw somewhat hasty conclusions. It has been claimed, for example, that a Beaver cuts down a tree in a way that will cause it to fall in any desired direction. This may or may not be true, but the facts do not seem to warrant such a statement. In early days I have seen a number of Beaver dams and have examined dozens of trees which had been cut down by the animals; some had fallen in a manner which would encourage such a belief, but on the other hand fully as many had not.

The well-known castorum or castor of commerce is a secretion of the castorum glands of the Beaver, which has a peculiar penetrating odor and which is highly attractive to the Beavers themselves, so much so that it is used as a bait by trappers. The usual method of using it is to place a little of the fluid on the end of a twig which extends over the trap, the latter being placed under the water. In trying to smell the stick the Beaver steps on the trap and is caught.

While it is probable that medical men of to-day would prefer to avail themselves of other remedies, it is interesting to learn that physicians of three hundred years ago considered the skin of the European Beaver, which is a close relative of ours, to possess decided therapeutic value. In writing of the European species in the early part of the seventeeth century, Edward Topsell* says:

"The medicinall vertues of this beast are in the skin. . . A garment made of the skinnes is good for a paralitick person, and the skinnes burned with drie Oynions and liquid pitch, stayeth the bleeding of the nose, and being put into the soles of shoes easeth the gowt."

Specimens examined from Wisconsin and adjoining states:
Michigan — Iron County, 5.
Wisconsin — (O. C.) Sawyer County (skull), 1.

* Historie of Foure Footed Beastes, London, 1607, p. 17.

Family MURIDÆ. Rats and Mice.

The *Muridæ* is the largest known family of mammals. Its members are practically cosmopolitan and number at least 450 known species, representing nearly 100 genera. They are all animals of small size, the largest being the Muskrat (*Fiber*). They have no premolars and never more than three cheek teeth (molars), the differences in the latter being often generically diagnostic. The antorbital foramen is large, the edges forming a nearly perpendicular slit in front of the zygoma in most species;* molars tuberculate or with enamel folds and with or without roots; the tibia and fibula are anchylosed below, and post-orbital processes are wanting. Four subfamilies are represented in North America including the introduced subfamily *Murinæ* containing Old World Rats and Mice.

KEY TO THE GENERA
WHICH OCCUR WITHIN OUR LIMITS.

GROUP 1. Grinding teeth (molars) of upper jaw with tubercles or rounded points on crowns extending in *three* longitudinal rows; tail nearly naked.

Mus.
Crowns of Molars.
(Enlarged.)

Total length (including tail) less than 10 inches. Genus MUS, p. 176.

Total length (including tail) more than 10 inches. Genus EPIMYS, p. 180.

GROUP 2. Grinding teeth (molars) of upper jaw with tubercles or rounded points on crowns extending in *two* longitudinal rows.

Peromyscus.
Crowns of Molars.
(Enlarged.)

SECTION 1. Skull showing a ridge over the eye socket.
Total length over 8.75 inches; hind feet decidedly large; incisors not grooved. Genus ORYZOMYS, p. 202.

SECTION 2. Skull not showing distinct ridge over eye socket.
Total length less than 8.75 inches; hind feet not decidedly large; incisors not grooved. Genus PEROMYSCUS, p. 183.
Size small, total length less than 5.50 inches; front of upper incisors with longitudinal groove. Genus REITHRODONTOMYS, p. 201.

GROUP 3. Crowns of grinding teeth (molars) with loops or irregular triangles clearly shown in upper jaw.

Neotoma.
Crowns of Molars.
(Enlarged.)

SECTION 1. Total length more than 12 inches.
Tail covered with hair; ears large; belly whitish. Genus NEOTOMA, p. 204.
Tail laterally compressed and naked for greater part of its length. Genus FIBER, p. 225.

*See fig. 5, p. 96.

Skulls of *Muridæ*. (About natural size.)

1, *Mus musculus;* 2, *Epimys norvegicus;* 3, *Peromyscus leucopus;* 4, *Oryzomys palustris:* 5, *Neotoma f. illinoiensis;* 6, *Evotomys gapperi;* 7, *Microtus pennsylvanicus;* 8, *Fiber zibethicus;* 9, *Synaptomys cooperi.*

SECTION 2. Total length less than 12 inches.

PART 1. Front of upper incisors (front teeth) not grooved.

Grinding teeth without pronged roots in adults; back and sides of body nearly uniform in color. Genus MICROTUS, p. 213.

Grinding teeth with pronged roots in adults; back with chestnut dorsal stripe (middle of back) in decided contrast with gray-brown of sides. Genus EVOTOMYS, p. 208.

Synaptomys. Upper Incisors. (Enlarged.)

PART 2. Front of upper incisors (front teeth) with distinct groove near outer edge. Genus SYNAPTOMYS, p.233.

KEY TO THE SPECIES.

This key is largely based on external characters for use in the field and is intended to apply to adult specimens only.

GROUP 1. Total length (including tail) more than 10 inches.

SECTION 1. Total length more than 18 inches. General color brown; fur thick and fluffy; tail hairless for the greater part of its length and laterally compressed. MUSKRAT. *Fiber zibethicus*, p. 225.

SECTION 2. Total length less than 18, but more than 10 inches.

PART 1. *Tail with little or no hair;* crowns of molars with tubercles.

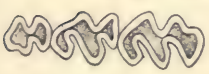
Length from nose to root of tail *less* than length of tail; general color blackish; under parts not white or yellowish white. Claimed to have occurred within our limits but no definite records. BLACK RAT. *Epimys rattus*, p. 181.

Length from nose to root of tail *less* than length of tail; upper parts brownish; under parts yellowish white or whitish. This species has not been observed within our limits but may occur. ROOF RAT. *Epimys alexandrinus*, p. 181.

Epimys. Crowns of Upper Molars. (Enlarged.)

Length from nose to root of tail greater than length of tail (never less); upper parts brownish; under parts brownish gray. Common in houses and barns. NORWAY RAT. BROWN RAT OR HOUSE RAT. *Epimys norvegicus*, p. 180.

PART 2. *Tail covered with hair*, crowns of molars with irregular triangles or loops. Upper parts brownish; under parts whitish; feet white; ears large; occurs only in southern Illinois. About the size of large House Rat, but readily distinguished from it by its hair-covered tail, large ears, and white feet.



Crowns of Upper Molars. (Enlarged.)

ILLINOIS WOOD RAT. *Neotoma floridana illinoensis*, p.204.

GROUP 2. Total length less than 10 inches; tail more than 2 inches long.

A. Species which occur in southern Illinois.

SECTION 1. Tail more than 2 inches, but less than 3.75 inches long.

PART 1. Under parts white or grayish white; upper parts brown, but not golden brown; middle of back darker brown that the sides.

Total length more than 7 in. (180 mm.); tail vertebræ about 3.12 in. (80 mm.) or more. WESTERN COTTON MOUSE. *Peromyscus gossypinus megacephalus*, p. 196.

Total length 6.62 to 7 in. (169 to 179 mm.); tail vertebræ 2.75 to 3 in. (70 to 77 mm.). WHITE-FOOTED MOUSE.
Peromyscus leucopus, p. 184.

Total length 5.50 to 6.50 in. (140 to 165 mm.); tail vertebræ *less* than 2.75 in. (70 mm.). PRAIRIE WHITE-FOOTED MOUSE.
Peromyscus maniculatus bairdi, p. 190.

Total length about 5 in. (128 mm.); tail vertebræ from 2 to 2.50 in. (50 to 65 mm.); back brown; sides grayish buff; a distinct longitudinal groove on front of upper incisors near outer edge. Not as yet recorded from within our limits but may occur. DYCHE'S HARVEST MOUSE.
Reithrodontomys dychei, p. 201.

PART 2. Under parts white or grayish white; upper parts including head rich, golden brown. SOUTHERN GOLDEN MOUSE.
Peromyscus nuttalli aureolus, p. 198.

PART 3. Under parts *mouse brown;* upper parts darker brown.
HOUSE MOUSE.
Mus musculus, p. 176.

SECTION 2. Tail 4 to 5 inches long.

Hair on tail very scanty; feet decidedly larger and broader than *Peromyscus;* upper parts brown; under parts grayish. The line of demarcation between color of sides and belly not decidedly abrupt as in *Peromyscus*. RICE FIELD MOUSE. RICE RAT.
Oryzomys palustris, p. 202.

B. Species which occur in northern Illinois or Wisconsin.

SECTION 1. Tail more than 2, but less than 3.75 inches long.

PART 1. Under parts white or grayish white; upper parts brown; middle of back darker brown than the sides.

Tail *less* than 2.75 in. (70 mm. long, usually from 55 to 68 mm.); total length 5.50 to 6.25 in. (140 to 160 mm.). Occurs in Illinois and southern Wisconsin.
PRAIRIE WHITE-FOOTED MOUSE.
Peromyscus maniculatus bairdi, p. 190.

Tail *more* than 2.75 in. (70 mm.) long; total length 6.38 to 7.37 in. (162 to 188 mm.); tail usually 2.87 to 3.25 in. long (72 to 83 mm.); no trace of whitish hairs at anterior base of ears.* Large specimens are often quite similar to small examples of *P. m. gracilis* but *gracilis* does not occur in southern Wisconsin or Illinois.
NORTHERN WHITE-FOOTED MOUSE.
Peromyscus leucopus noveboracensis, p. 185.

* Mr. Wilfred H. Osgood gives the following characters by which *P. l. noveboracensis* and *P. m. gracilis* may be distinguished (Revision of the Mice of the American Genus *Peromyscus*, N. Amer. Fauna, No. 28, 1909, pp. 35 and 42.):

"*P. m. gracilis.* Tail longer, more distinctly pencillate and more sharply bicolor; pelage slightly softer, with or without white hairs at the anterior base of the ear.

P. l. noveboracensis. Tail shorter and less sharply bicolor, slightly or scarcely pencillate; never with white spot at anterior base of the ear."

Tail more than 2.75 in. (70 mm.) long; total length from 6.87 to 7.50 in. (175 to 190 mm.); *tail usually 3.25 to 4 in.* (80 to 100 mm.); some specimens show whitish hairs at the anterior base of the ears. Usually distinguished by size and length of tail from *P. noveboracensis*.

CANADIAN WHITE-FOOTED MOUSE.
Peromyscus maniculatus gracilis, p. 193.

PART 2. Under parts mouse brown; upper parts darker brown.

HOUSE MOUSE.
Mus musculus, p. 176.

SECTION 2. Tail more than 4 inches long.

Tawny brown on sides of body; back darker brown; sides of belly tinged with pale brownish yellow; front of upper incisors with distinct longitudinal groove. This species belongs to family *Zapodidæ* and does not properly belong here, but might be looked for in this family by those not familiar with mammals. JUMPING MOUSE.
Zapus hudsonius, p. 247.

GROUP 3. Total length less than 10 inches; tail less than 2 inches long.

SECTION 1. Total length more than 5.50 inches; tail more than 1.25 inches long.

Tail usually *less than 1.60* inches long; dark brown hairs of upper parts tipped with light grayish brown, giving a grizzly effect of mixed light and dark brown hairs; under parts grayish brown; plantar tubercles 5; mammæ 6. PRAIRIE MEADOW MOUSE.
Microtus ochrogaster, p. 218.

Tail usually *more than 1.60* inches long; fur on upper parts softer and darker brown and lacking the grizzly effect of *M. ochrogaster;* under parts distinctly grayish or plumbeous gray, not brownish gray or gray brown, as in *ochrogaster;* plantar tubercles 6; mammæ 8. MEADOW MOUSE.
Microtus pennsylvanicus, p.214.

SECTION 2. Total length less than 5.50 inches.

PART 1. Front of upper incisors (front teeth) with distinct groove near outer edge.

Front view of Upper Incisors. (Enlarged.)

Total length usually *more* than 4.75 inches; tail less than 1 inch long. Occurs in Illinois and perhaps southern Wisconsin.

COOPER'S LEMMING MOUSE.*
Synaptomys cooperi,
AND GOSS'S LEMMING MOUSE.
Synaptomys cooperi gossi, p. 233.

Total length less than 4.75 inches; tail less than 1 inch long; skull smaller and incisors narrower and smaller than *S. cooperi*. Occurs so far as known within our limits only in northern Wisconsin.

BANGS'S LEMMING MOUSE.
Synaptomys cooperi fatuus, p. 237.

*I have seen no specimens of typical *cooperi* from Illinois, but intermediates between *cooperi* and *gossi* occur in the northeastern part of the state. *S. c. gossi* occurs in southern Illinois.

PART 2. Front of upper incisors (front teeth) without distinct groove near outer edge.

Upper parts nearly uniform brown in color; tail not exceeding 1 inch in length and usually less. GREATER PINE MOUSE.
Microtus pinetorum scalopsoides, p. 222.

Upper parts with wide *chestnut* dorsal stripe (down middle of back) in decided contrast to gray brown of sides; tail more than 1 inch long.
RED-BACKED MOUSE.
Evotomys gapperi, p. 208.

Subfamily MURINÆ.

An Old World subfamily of which several species have been introduced into America. The characters as given for the following genera will answer our purpose here.

Genus **MUS** Linn.

Mus Linnæus, Syst. Nat., X ed., I, 1758, p. 59. Type *Mus musculus* Linn.

Front teeth (incisors) two in each jaw; no premolars; three molars or grinding teeth in upper jaw having tubercles on crowns arranged in three longitudinal rows; incisors narrow and without groove; crown of anterior molar larger than both the others combined; third molar very small; edges of anteorbital foramen forming a nearly perpendicular slit in front of zygoma; tail long and usually nearly naked and scaly; hind feet with five developed toes; fore feet with four developed toes and a rudimentary pollex with short nail. Originally this genus included the Old World Rats and Mice, which have been introduced in the United States, but is now restricted to a single species, the House Mouse, the Rats having been separated and placed in the genus *Epimys*.

Crowns of Upper Molars.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3} = 16$.

Mus musculus LINN.

HOUSE MOUSE.

[*Mus*] *musculus* LINNÆUS, Syst. Nat., X ed., I, 1758, p. 62.

Type locality — Sweden.

Distribution — Old World species, now generally distributed throughout the settled portions of the United States, about buildings and in cultivated fields and occasionally in unsettled districts.

Special characters — Under parts grayish brown, paler than the back but with no abrupt line of demarcation; length, 6 to 7 inches. The grayish brown under parts (not white or whitish), in connection with its size and length of tail, will distinguish it from others of our Mice.

Description — General color brown, the dark brown shading gradually to lighter brown on the sides of the body and grayish brown on the belly; tail very scantily haired; molars or grinding teeth having tubercles on crowns forming three longitudinal rows.

Measurements — Total length, 6.75 in. (171.4 mm.); tail vertebræ, 3.15 in. (80 mm.); hind foot, .75 in. (19 mm.).

The House Mouse is an introduced species which has become distributed practically throughout North America in districts inhabited by man and occasionally away from settled localities. On account of its small size it does not do so much damage as its larger relative, the Rat, but its presence is considered equally undesirable, and its ability to get through very small holes often enables it to gain access to the drawer of a desk, where it immediately begins operations by reducing letters and papers contained therein to a mass of shreds to be used as a soft bed for a litter of young Mice. When present in any numbers the amount of food they consume is considerable, and their depredations in pantries and storerooms is too well known to require comment.

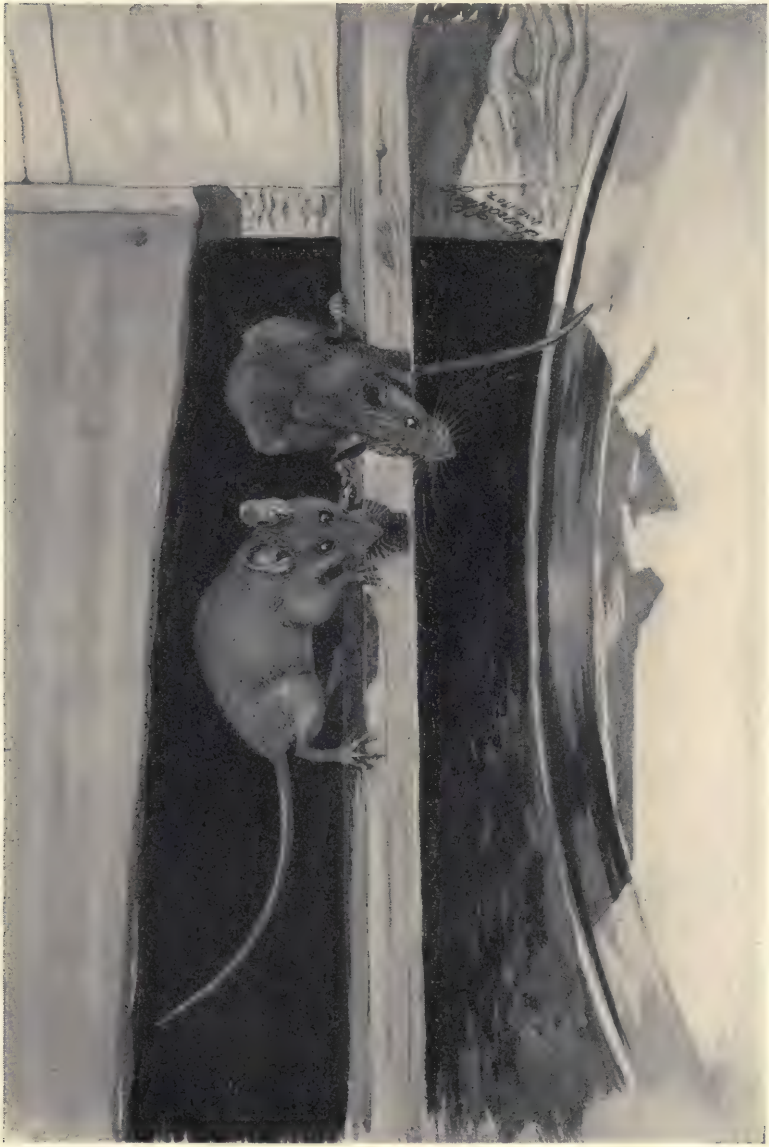
They are unfortunately very prolific, several litters being born in a season. From 4 to 9 young are born in a litter, the usual number being 5 or 6. The young ones reach the age of maturity when less than three months old.

The ordinary vocal sounds produced by a House Mouse may be described as a shrill squeak, but several writers have given it credit for what they describe as a "song." Mr. Seton says,* "Most persons are surprised to hear of singing Mice. The first I met was in my New York residence. Out of the black darkness of a cupboard at midnight came a prolonged squeaking, thrilling and churring, suggestive of a canary's song but of thinner and weaker quality. There could be no question that it was a 'singing mouse.' Many cases are on record."

All efforts to exterminate the House Mouse in the United States have failed and, if anything, their numbers appear to be increasing. In this connection it is interesting to note that three hundred years ago the householder in England was annoyed by these little pests fully as much as are those of the present day; at least in 1607 Edward Topsell devoted several pages to describing various methods whereby they could be trapped or killed. He says:†

* Life Histories of Northern Animals, I, 1909, p. 482.

† Historie of Foure Footed Beastes, London, 1607, pp. 509–510.



House Mouse (*Mus musculus*).

"For these causes have men invented many devises, snars, and gins, the generall wherof is called by the Latines *Muscipula* and by the Gretians *Muspala* and *Miagra*, the divers and severall formes whereof I will not disdaine to set down. For the wise reader must consider that it is as necessary or rather more necessary for most men to know how to take mice, than how to take Elephants.

"And although every woman, and silly Rat-ketcher can give instructions enough therein, yet their knowledge cannot excuse my negligence if I should omit the inventions and devices of the auncient, whereby they delivered themselves from the annoiances of these beasts. And therefore first of al to declare the manner of ketching them . . .

"And also it is reported of those which have tryed the same, that if Mice fall into a vessell without water, and remaine there a long time without meate, that then they devoure one another, but if they remaine there so long untill one among them all be left alone, that is to say the strongest of them all, and that he be suffered to go out, wheresoever hee shall finde any mice hee will eate them up, and they shall have much adoe to escape him, because he hath been so long accustomed unto them. I was told also of a certaine friend of mine, that a man of *Senensis* did set a purse in a hollow place, and made it to open and shut by some device, so that at length he tooke a mouse, which mouse hee fed onely with the flesh of Mice, and after he had fed it so a long time, he let it go, who killed all the Mice that he did meete, and was not satisfied with them, but went into every hole that he could find, and eat them up also. Also Mice are taken in vessels, from whence they cannot escape, upon the which vessell let there be put a small staffe, which is so cut in the middle, that she may onely hold her selfe by the meate, and when you have so doone, put the kernell of a Nut upon the middle of the staffe, to the which the Mouse comming, doth fall into the vessell with the staffe, and they will be stifeled if their be any Water: but if there be none she will be killed."

After devoting several more pages to methods of destroying Mice both with traps and poisons, he adds:

"The Scythians were woont to be clad with the skinnes of mice and Wolves, and it is observed, that when mice cry and screeketh above their ordinary custome, it pressageth an alteration and change of the Weather, and thus much shall suffice for their naturall discourse."

Specimens examined from Illinois and Wisconsin:

Illinois — Chicago, 6; Olive Branch, Alexander Co., 2; (O.) Chicago, 12 = 20.

Wisconsin — Beaver Dam, Dodge Co., 1; (O.) Lake Geneva, 8 = 9.

Genus **EPIMYS** Trouessart.

Epimys Trouessart, Catal. Mamm. Viv. et Foss., Bull. Soc. d'Etudes, Sci. d'Angers, X, 1881, p. 117. Type, by subsequent designation, *Mus rattus* Linn. Miller, Proc. Biol. Soc. Wash., XXIII, 1910, p. 58.

Front teeth (incisors) 2 in each jaw; no premolars; upper molars or grinding teeth having tubercles on crowns arranged in three longitudinal rows as in *Mus*; "molars slightly graduated in size from first to third, the anterior tooth not tending to assume the main function of the toothrow, the posterior tooth not tending to disappear, enamel folding of upper molars directly referable to a simple 9-cusped pattern and its reductions, the outher margin of M^1 and M^2 never with more than three cusps, the inner margin of same teeth never with more than 2 cusps, M^1 usually with 5 roots, its first lamina not distorted by the backward displacement of antero-internal tubercle; upper incisor moderately compressed, set at such an angle that its outer side is worn smoothly away by action of lower teeth." (Miller.)

Epimys norvegicus (ERXLEBEN).

NORWAY RAT. BROWN RAT. HOUSE RAT.

[*Mus*] *norvegicus* ERXLEBEN, Syst. Regni Anim., I, 1777, p. 381. JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 20 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 492 (Indiana).

Mus decumanus KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Illinois). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 192 (Tennessee).

Neotoma floridana WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 550.

Type locality — Norway.

Distribution — Nearly cosmopolitan. In America generally distributed throughout the country wherever there are habitations of men.

Description — Hair coarse; general color brown, darkest on middle of back; under parts pale grayish brown; tail scaly and very scantily haired; *tail not longer than head and body*, usually less.

Measurements — Total length, about 15.50 in. (394 mm.); tail vertebræ, about 7.12 in. (180 mm.); hind foot, 1.75 in. (45. mm).

This species was introduced in North America some time during the latter part of the eighteenth century and in spite of all attempts to exterminate it, it has thrived and increased to a remarkable degree. Of its habits little need be said. They are destructive to property and in agricultural districts consume a large amount of grain and food of every kind wherever they can find it. They are also objectionable from an

hygienic point of view. The spread of the Bubonic Plague has been proved to be due to them* and it can readily be understood how they could easily become a source of contagion for other diseases as well. To those who suffer from their depredations a publication of the U. S. Department of Agriculture entitled "How to destroy Rats," by D. E. Lantz, (Farmers' Bulletin, No. 369, 1909) is recommended. In writing of this species Dr. C. Hart Merriam says,† "He is not content with deriving his sustenance at our expense; but to save himself the trouble of a walk between meals, takes up his abode in or under our dwellings and outhouses. In unsettled regions he often makes long journeys from house to house, but I have never known him to make his home at any great distance from buildings.

"Rats are good swimmers, and in their migrations from place to place (which are usually performed at night and thus escape notice) they do not hesitate to swim rivers and ponds that lie in the way. Though chiefly nocturnal, they are often seen in the daytime. They are exceedingly prolific, commonly bringing forth from seven to twelve young at a birth, and having several litters each season. Some idea of the number of Rats inhabiting large cities may be had from the fact that, at Paris, in a fortnight's time, more than six hundred thousand were killed in the sewers. The skins were manufactured into kid gloves."

Specimens examined from Illinois and Wisconsin:

Illinois — Chicago, 2; Fox Lake, 8 (6 in alcohol); (I. S. L.) Havana, 1 = 11.

Wisconsin — Beaver Dam, Dodge Co., 2; (O.) Lake Geneva, 4 = 6.

The following introduced species may occur in Illinois, but I find no satisfactory record of either having actually been taken in the state:

Epimys rattus (Linn.). (Syst. Nat., X ed., I, 1758, p. 61.) Type locality — Sweden. A nearly cosmopolitan species introduced in North America at an early date. It was formerly common in many parts of the United States, but since the advent of the Norway or Brown Rat, has become rare except in scattered localities. It has been recorded from Indiana, Tennessee, Kentucky and Iowa, and is claimed to have occurred in Illinois in early days. It has also been accredited to Wisconsin by Lapham and Strong; but its occurrence in that state requires further confirmation.

Epimys alexandrinus (Geoffroy). (Descr. Egypt, II, 1818, p. 733.) Type locality—Egypt, Africa. This species has a much more south-

* The Rat is very susceptible to the disease and a large number of the Rat fleas examined in infected houses contained the *Bacillus pestis* in their stomachs and mouths.

† Mamm. Adirondack Reg., 1886, pp. 259–60.

Norway Rat or House Rat (*Epimys norvegicus*).

ern distribution than the Norway Rat. Since its introduction into this country it has become well established and is not uncommon in Louisiana and other Southern states. So far as known, it has not been taken in Illinois.

The three species may be distinguished by the following characters:

Length from nose to root of tail generally greater than length of tail (never less); upper parts brown; under parts brownish gray. A very common species.
BROWN RAT OR NORWAY RAT.
Epimys norvegicus.

Length from nose to root of tail less than length of tail; general color blackish, under parts not white or yellowish white. Doubtful if it occurs within our limits.
BLACK RAT.
Epimys rattus.

Length from nose to root of tail less than length of tail; upper parts brownish; under parts yellowish white or whitish. Not known to occur in Illinois and Wisconsin.
ROOF RAT.
Epimys alexandrinus.

Subfamily CRICETINÆ.

This subfamily is of almost cosmopolitan distribution. The tubercles on molars of upper jaw are arranged in two longitudinal rows.

Genus **PEROMYSCUS** Gloger.

Peromyscus Gloger, Hand. u. Hilfsb. Naturg., I, 1841, p. 95. Type *Peromyscus arboreus* Gloger = *Mus sylvaticus noveboracensis* Fischer.

Crowns of Upper Molars.

Molars or grinding teeth with *two* rows of tubercles on rounded points or crowns; zygoma very slender; tail at least 2 inches long; belly white or whitish; soles of hind feet with 5 or 6 tubercles or wart-like excrescences; size approaching that of the House Mouse.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3}=16$.

FIELD KEY TO OUR SPECIES.

GROUP 1. Species which occur in about the northern two-thirds of Illinois and about the southern half of Wisconsin.

Tail less than 2.75 inches long.
PRAIRIE WHITE-FOOTED MOUSE.
Peromyscus maniculatus bairdi, p. 190.

Tail more than 2.75 inches long.
NORTHERN WHITE-FOOTED MOUSE.
Peromyscus leucopus noveboracensis, p. 185.

GROUP 2. Species which occur in southern Illinois.

SECTION 1. General color of upper parts brown but not golden brown.

Total length usually more than 7 inches; tail vertebræ more than 3 inches. WESTERN COTTON MOUSE.
Peromyscus gossypinus megacephalus, p. 196.

Total length less than 7 inches (usually about 6.75 in.); tail vertebræ not exceeding 3 inches (usually 2.75 to 3 in.). WHITE-FOOTED MOUSE.
Peromyscus leucopus, p. 184.

Total length 5.50 to 6.50 inches; tail vertebræ less than 2.75 inches. PRAIRIE WHITE-FOOTED MOUSE.
Peromyscus maniculatus bairdi, p. 190.

SECTION 2. General color of upper parts golden brown. Upper parts, including head, rich golden brown. SOUTHERN GOLDEN MOUSE.
Peromyscus nuttalli aureolus, p. 198.

GROUP 3. Species which occur in northern Wisconsin.

Tail vertebræ usually from 3.25 to 4 inches long. CANADIAN WHITE-FOOTED MOUSE.
Peromyscus maniculatus gracilis, p. 193.

Subgenus **PEROMYSCUS** Gloger.

Plantar tubercles 6; ears dark or dark with whitish edges; dentine spaces of molars mostly confluent.

Peromyscus leucopus (RAFINESQUE).

WHITE-FOOTED MOUSE. DEER MOUSE. WHITE-FOOTED WOOD MOUSE.

Musculus leucopus RAFINESQUE, Amer. Monthly Mag., III., 1818, p. 446.
Peromyscus leucopus RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 187 (Tennessee). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 496 (Indiana). OSGOOD, N. Amer. Fauna, No. 28, 1909, p. 113 (Kentucky, Tennessee, etc.).

Type locality — Western Kentucky.

Distribution — From the Atlantic coast of Virginia and North Carolina westward around the southern end of the Allegheny Mountains, through northern South Carolina and Georgia to Oklahoma, north to southern Illinois and south to southern Louisiana.

Description — Adult: Upper parts brown, darker on middle of back than on sides; under parts white, the concealed bases of the hairs slaty gray, the tips white; upper surface of tail brown, under surface whitish.

Young: Feet white; plumbeous gray all over except the belly where the hairs are tipped with white.

Measurements — Total length, about 7 in. (178 mm.); tail vertebræ, 3 in. (76 mm.); hind foot, .85 in. (21 mm.).

This species occurs in southern Illinois. Its habits are similar to those of the Northern White-footed Mouse, *Peromyscus leucopus noveboracensis*.

Specimens examined from Illinois:

Illinois — Reevesville, Johnson Co., 14; Ozark, Johnson Co., 18; Golconda, Pope Co., 8; Olive Branch, Alexander Co., 8 = 48.

Peromyscus leucopus noveboracensis (FISCHER).

NORTHERN WHITE-FOOTED MOUSE.

NORTHERN WHITE-FOOTED WOOD MOUSE. WOODLAND DEER MOUSE.

[*Mus sylvaticus*] *Noveboracensis* FISCHER, Synopsis Mamm., 1829, p. 318.

Mus leucopus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 90 (Illinois). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 117.

Vesperimus leucopus HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 178 (Minnesota).

Hesperomys leucopus ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 192 (Iowa).

Peromyscus leucopus noveboracensis JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 21 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 497 (Indiana). OSGOOD, N. A. Fauna, No. 28, 1909, p. 117 (Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Wisconsin, etc.). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 539 (Illinois).

Type locality — New York.

Distribution — Northern United States, Nova Scotia and a small portion of southern Ontario, west to Minnesota, south to Missouri, south-central Illinois and Indiana (where it intergrades with *P. leucopus*), eastern Tennessee and Virginia. (See map.)

Description — Similar to *P. leucopus* but *averaging* slightly larger and somewhat paler; fur somewhat longer and softer.

Measurements — Total length, about 7 in. (178 mm.); tail vertebræ, about 3 in. (76 mm.); hind foot, .87 (22 mm.).

The Northern White-footed Mouse is normally an inhabitant of the woods, although in summer it is often found in pastures where there are bushes and stumps. Old corn shocks are favorite resorts of these Mice, but they are not commonly found at any great distance from timber-land of some sort; although Snyder states that he has "taken them in traps in grassy fields a mile from any timber" (*l. c.*, p. 117). It builds its nest under logs or in an old hollow log or pile of brush, and again in bushes. I have found several of the latter, none of which

Northern White-footed Mouse (*Peromyscus leucopus noveboracensis*).

was more than three feet from the ground and in most cases an old bird's nest had been altered and made use of. The nest is composed of small twigs, grass and leaves. When in the ground, perhaps under an old stump, it is reached by short underground tunnels. These animals do not hibernate. They are active in winter and store up grain and seeds for their use during the cold weather. The young number from 4 to 6 and two or three litters are born in a season.

Concerning the habits of this species in northern Illinois, Kennicott writes, "In this vicinity, the *Mus leucopus* appears to inhabit the timber only. I never observed one on the prairie. It is found in wooded farms, where it is more or less injurious to the farmer, carrying off and devouring grain, destroying various young plants, and occasionally doing much mischief by gnawing the bark of fruit-trees. On the whole, however, it cannot be considered very injurious. Though it may inhabit grain-fields in harvest time, it is decidedly a timber lover, and never breeds nor takes up its residence permanently in large fields, clear of trees, stumps and logs. Its home is usually in an old stump or fallen log, under the bark of decayed trees, and sometimes in hollow trees, at a considerable height above the ground. It sometimes takes possession of deserted birds' nests, and occasionally builds in the branches of trees. Dr. Hoy informs me that he has seen several of its nests in southern Wisconsin. They are usually placed among the thick branches of a thorn, at a height of 8 or 10 feet from the ground. The nests were composed of grass, and were of globular form, the entrance being a small hole on one side. I have also found nests on the ground, under logs, and once in August, found a female, about to bring forth young, in a nest of grass under a small block of wood on a low river bottom. . . . This mouse is sometimes gregarious, as many as a dozen having been found together in winter. . . .

"The white-footed wood-mouse feeds chiefly upon the leaves and seeds of various grasses and other herbaceous plants, with nuts, acorns, and the seeds of basswood, maple, and other trees; grain is also eaten greedily by it in the fields. It lays up considerable stores of food in winter.

"This species is active in winter, like the rest of the genus, moving about a good deal on top of the snow, as well as below it, and sometimes travelling a long distance at this season. Mr. Lawrence Koebelin tells me that, in cold weather, in December, he found one which had collected grass and formed a large nest in a pile of wood within two days after it had been cut.

"The female exhibits much affection for her young. These, when small, I have always found attached to her teats, in which way she

would carry them off, moving, unless chased, with great caution, as though she feared to injure them. A neighbor relates that in turning over a log in the woods, he exposed one of these mice, which, instead of jumping off rapidly, moved slowly away along a small log, and was observed to have several young attached to her teats. Her movements being watched with interest, one of the young was seen to be brushed off and fall among the grass, the mother passing on out of sight. The young mouse left was quite helpless and continued to utter a low squeak. After a while, the mother returned to it, and though her movements could no longer be observed, the voice of the young mouse ceased, and upon examination of the spot, it was found to have disappeared with the mother. It is not to be supposed, however, that the young of this mouse are attached to the mammæ of the parent like those of the opossum" (*l. c.*, pp. 90–91).

"Caged specimens do not eat flesh and are not at all pugnacious" (Kennicott, *l. c.*, pp. 90–91). This last statement by Kennicott does not agree with observations of later writers. I have known a wild one to eat part of a dead bird and in captivity it will readily eat meat. Dr. C. Hart Merriam says,* "The White-footed Mouse is fond of flesh, and, like the flying squirrel, eagerly devours dead birds placed in its way." Mr. W. L. Hahn writes, "A number of white-footed mice were left in captivity at different times, but they could not be kept together. On one occasion six were caught under corn shocks and were divided equally between two cages. Next morning each cage contained two partially eaten carcasses, while of the survivors in each cage one died within a few hours and the other a day later (*l. c.*, p. 499). This Mouse is naturally gentle and rarely attemps to bite even when just caught. When in captivity it soon becomes very tame and makes an amusing pet.

Specimens examined from Illinois, Wisconsin and adjoining states:

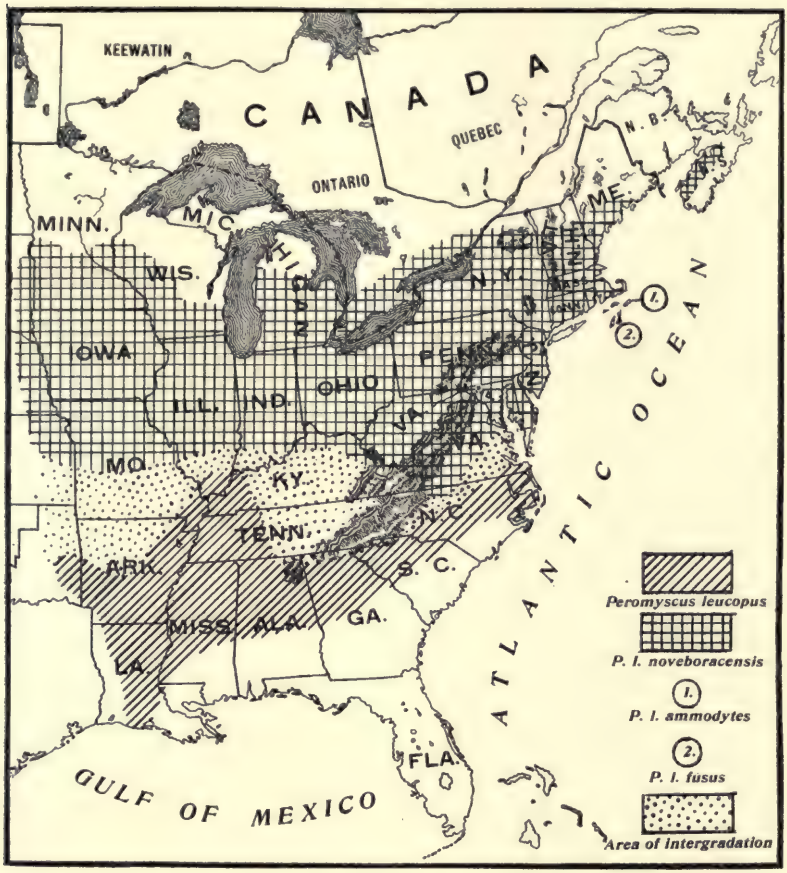
Illinois — Fox Lake, 18; Camp Logan, 6; Warsaw, 1; Galena, 9 = 34.

Wisconsin — Delavan Lake, 2; Camp Douglas, 3; Beaver Dam, 14; (M. P. M.) Milwaukee, 4; Prescott, Pierce Co., 98; Maiden Rock, 21; Yellow River, Burnett Co., 10; Newport, Door Co., 3; Delavan, 9; Polk Co., 1; Prairie du Sac, Sauk Co., 41; Grant Co., 2; (O. C.) Whitefish Bay, Milwaukee Co., 9; Nashotah, Waukesha Co., 10 = 224.

Indiana — Mitchell, 1; La Porte, 3 = 4.

Michigan — Dowagiac, Cass Co., 13.

* Mamm. Adirondack Reg., 1886, p. 265.



Map illustrating the approximate distribution of the White-footed Mice (*Peromyscus leucopus* and races) in eastern United States.

Peromyscus leucopus (RAFINESQUE). Type locality — Western Kentucky. Description as previously given.

Peromyscus l. noveboracensis (FISCHER). Type locality — New York. Similar to *leucopus*, but slightly larger and somewhat paler; pelage longer.

Peromyscus l. ammodytes BANGS. (Proc. New Engl. Zoöl. Club, IV, 1905, p. 14.) Type locality — Monomoy Island off coast of southeastern Massachusetts. Similar to *noveboracensis*, but under parts pure white to roots of hairs.

Peromyscus l. fusus BANGS. (Proc. New Engl. Zoöl. Club, IV, 1905, p. 13.) Type locality — West Tisbury, Island of Martha's Vineyard, off south coast of Massachusetts. Similar but averaging larger than *noveboracensis*, and rostrum of skull slightly more elongated.

Peromyscus maniculatus bairdi (HOY & KENNICOTT).

PRAIRIE WHITE-FOOTED MOUSE.
PRAIRIE DEER MOUSE. BAIRD'S DEER MOUSE. MICHIGAN DEER MOUSE.

Mus bairdii HOY & KENNICOTT, in Kennicott, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 92.

Peromyscus bairdi SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 116 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 40 (Wisconsin).

Peromyscus michiganensis JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 72 (Missouri). *Ib.*, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 21 (Wisconsin). HAHN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 459 (Indiana).

Peromyscus maniculatus bairdi HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 502 (Indiana). OSGOOD, N. Amer. Fauna, No. 28, 1909, p. 79 (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Wisconsin, etc.). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 26 (Illinois, Missouri). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 544 (Illinois).

Type locality — Bloomington, McLean Co., Illinois.

Distribution — Prairie region of the upper Mississippi Valley in Wisconsin, Illinois, Indiana, Minnesota, eastern Ohio, Iowa, Missouri, Oklahoma, and eastern portions of Nebraska, Kansas, South Dakota, and North Dakota; north to southern Manitoba.

Special characters — Resembles *P. l. noveboracensis* but somewhat smaller, tail shorter, and general color slightly darker (less brownish).

Description — Upper parts brown, the middle of the back dark brown, much darker than the sides; under parts white or whitish, the bases of the hairs slaty gray, the tips white. When the hair is short and worn, the dark bases are not entirely concealed, giving a grayish appearance to the under parts. Upper surface of tail dark; under surface pale.

Measurements — Total length, 5.50 to 6.50 in. (140 to 165 mm.); tail vertebræ, 2.25 to 2.75 in. (57 to 69.5 mm.); hind foot, .70 to .75 in. (18 to 19 mm.).

The Prairie White-footed Mouse is abundant in suitable localities in the greater portion of Illinois and Wisconsin, and, as its name implies, it inhabits dry, cultivated fields and prairies, but it also is found in open woods where the growth is small and scattered. Regarding its habits, I cannot do better than to quote Robert Kennicott who had unusual opportunities for observing it. He says, "Not having, on the prairies, the shelter found by its timber-loving cousins, in old stumps and trees, this species digs burrows. These are rather simple, with few or no side-passages, and often with but one entrance, the depth and extent being variable, but never great. The nest is small, com-

Prairie White-footed Mouse (*Peromyscus maniculatus bairdi*).

posed of soft grass, etc.; it is spherical, and the small internal cavity is entered through a narrow opening on one side. In cultivated fields the burrows are frequently dug at the roots of fruit-trees, the bark of which is often gnawed, sometimes causing great injury. In nurseries, fruit-trees are often taken up and 'heeled in'; that is, laid down close together, with the roots placed in a trench, and then covered in such manner that they are kept safely in a very small space, and can be readily pulled out when desired. The loose earth among the roots of these offers an inviting habitation to the mice; and, in nurseries infested by them, they will be found burrowing in almost every lot of trees thus buried, where they feed upon the bark of the roots, and thus cause serious damage. In the fall, they are often found in corn-shocks, making a nest among the stalks, though they do not so often burrow under these as the arvicolæ. But, during winter, they may be tracked in corn-fields from their burrows to the neighboring corn-shocks, which they have visited for food. In spring, the young are always produced in burrows. During the summer, however, they occasionally are observed in nests, under bits of wood or bunches of hay, on the surface of the ground. In autumn, I have found nests of the young in small burrows only a few inches below the surface, or under an inverted sod. I have never observed more than one pair of adults occupying the same burrow; and, unlike the Mus leucopus, this species never appears to be gregarious.

"This mouse must be very prolific. I have found the young in March and April, and observed two females, each with five young, apparently but a few days old, about the tenth of November, while they are found in every intervening month. In nearly every instance within my observation the number of young produced at a birth has been five. I once found six, and have at times, though rarely, seen three or four. The young are found attached to the teats, as in the species last described; and a female was seen to carry five for several rods in this way, jumping along rapidly despite their weight. As soon as they are able to take care of themselves, the young leave the mother. In summer, I have several times found one apparently but a few weeks old, living alone in a nest made by himself. In spring, I have always found the old male living with the female and young; but during the summer, I have sometimes observed the male leading a solitary life, and the females and young in burrows by themselves. The food of this mouse, on the prairies, appears to be herbaceous plants, with their seeds; but I have been unable to see that it ever digs for roots. It is interesting to observe that this, like the Mus leucopus, seeks its food on the top of the ground, running on the snow in winter

in search of seeds, and collecting them in autumn instead of roots, when it travels as often by springing over the grass as by running through it. This mouse probably feeds more or less upon insects, as it is carnivorous in captivity; though some specimens are much less so than others. On one occasion, I captured a pair with five young, and placed them all in a cage well supplied with various kinds of vegetables and grain. The next day, several of the young were killed and eaten, and in two or three days, they had all disappeared. Shortly afterwards, the male, which had been slightly injured, was found dead, and partly devoured by his rapacious spouse. After this, I fed my specimens with meat, as well as grain, which they ate; and, as long as they were supplied with it, they lived together harmless; but no sooner was this withheld, than the old ones, both male and female, devoured their young." (*l. c.*, pp. 93–94.)

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Olive Branch, 6; Fox Lake, 17; Reevesville, 3 = 26.
Wisconsin — Beaver Dam, 35; Milton, 1; Delavan, 1; (M. P. M.) Jefferson Co., 2; Prescott, Pierce Co., 38; Maiden Rock, 1; Delavan, 3; Newport, Door Co., 3 (not typical); Kelly Brook, Oconto Co., 1; Prairie du Sac, Sauk Co., 41; Wyalusing, Grant Co., 2 = 128.
Indiana — La Porte, 2; Denver, 2 = 4.
Minnesota — Ft. Snelling, 2; Steel County, 4 = 6

Peromyscus maniculatus gracilis (LECONTE).

CANADIAN WHITE-FOOTED MOUSE. CANADIAN DEER MOUSE.

Hesperomys gracilis LECONTE, Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 442.
Peromyscus canadensis ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 20 (Wisconsin).
Peromyscus maniculatus gracilis OSGOOD, N. Amer. Fauna, No. 28, 1909, p. 42 (Michigan, Minnesota, Wisconsin, etc.).

Type locality — Michigan.
Distribution — "Northeastern United States and southern Canada, from northern Minnesota east through northern Wisconsin, Michigan, Ontario, Quebec, New York and western New England. Canadian Zone" (Osgood).
Special characters — Somewhat similar to *P. m. bairdi*, but total length greater and tail decidedly longer; more likely to be confounded with *P. l. noveboracensis*, which it often closely resembles. (For distinguishing characters, as compared with that species, see footnote page 174.)

Description — General color of upper parts brown, somewhat variable in shade (usually from dull cinnamon to isabella color); middle of back darker brown than sides; ears brown with a faint whitish edging when closely examined, occasionally a few whitish hairs at anterior bases of ears, but often absent; a blackish spot at the base of the whiskers; hairs on under parts of body white at tips, the bases plumbeous gray; the general color of under parts white or grayish white according to the condition of the pelage; feet white; upper surface of tail brown with narrow white edge, under surface white; tip of tail pencillate.

Measurements — Total length, 6.87 to 7.50 in. (175 to 190 mm.); tail vertebræ, 3.75 to 4 in. (80 to 100 mm.); hind foot, .80 to .87 in. (20 to 22 mm.).

The Canadian White-footed Mouse occurs within our limits in the Pine regions of northern Wisconsin, where it is common in deep woods. It may be looked for near water courses, among rocks, and about old logs. A favorite resort of this mouse is in and about old log cabins. So far as known, its habits differ but little from other Wood Mice belonging to the genus. In Wisconsin it not uncommonly makes its nest in a hollow log or stump, or in openings between the logs of old cabins. In such places the nest is in the middle of a rounded mass of grass often mixed with leaves and small pieces of bark.

Ernest Thompson Seton in writing of the habits of the closely allied northern form, *P. m. arcticus*, which undoubtedly differ little if any from that of *gracilis*, says,* 'When the nest is disturbed so that the mother runs out, she commonly carries off some or even all of her brood attached to her teats. This, however, is not her regular mode of carrying them about, but is rather due to the fact that the young when very small attached themselves firmly to the teat, almost in marsupial style, and the mother has not time to disengage herself if suddenly driven forth. Most of the Deermice carry their young in the mouth, one at a time, when they move them, just as a cat does her kittens."

Specimens examined from Wisconsin and adjoining states:

Wisconsin — Solon Springs, 4; Spread Eagle, 4; Lac Vieux Desert, Vilas Co., 11; (M. P. M.) Upper St. Croix Lake, Douglas Co., 7; St. Croix Dam, 6; Eagle River, 2; Mercer, 1; Namekagan River, Burnett Co., 9; Marinette Co., 2; Cataline, 2; Divide, Vilas Co., 4 = 52.

Michigan — Park Siding, 4.

* Life Histories of Northern Animals, I, 1909, p. 496.

Map illustrating approximate range of the Prairie White-footed Mouse (*P. m. bairdi*) and the Canadian White-footed Mouse (*P. m. gracilis*), which occur within our limits, together with the southern portion of the range of *P. maniculatus* and type localities of other geographical races of *maniculatus*, which occur in eastern United States and Canada.

Peromyscus maniculatus (WAGNER). (Wieg. Arch. f. Naturg., XI, I, 1845, p. 148.) Type locality — Labrador. Upper parts brown, the middle of the back decidedly darker than the sides; under parts white or grayish white (the hairs plumbeous gray at bases with white tips); tail bicolor and pencillate (blackish above, whitish below). Total length, 7 to 7.75 in. (178 to 197 mm.); tail vertebræ, 3 to 3.75 in. (76 to 95 mm.); hind foot, .75 to .87 in. (19 to 22.5 mm.).

Peromyscus m. gracilis (LECONTE). Type locality — Michigan. Similar to *maniculatus* but tail longer (3.75 to 4 inches), hind foot smaller and skull smaller and narrower; characters and measurements given on page 194.

Peromyscus m. bairdi (HOY & KENNICOTT). Type locality — Bloomington, McLean County, Illinois. Somewhat darker, tail shorter (less than 2.75 in.); for description and measurements see page 190.

Peromyscus m. abietorum (BANGS). (Proc. Biol. Soc. Wash., X, 1896, p. 49.) Type locality — James River, Nova Scotia. Similar to *gracilis*, but paler and somewhat grayer.

Peromyscus m. eremus OSGOOD. (N. Amer. Fauna, No. 28, 1909, p. 47.) Type locality — Pleasant Bay, Grindstone Island, Magdalen Islands. "Similar to *P. m. abietorum*, but color darker and tail shorter; similar to *P. maniculatus*, but paler and slightly smaller." (Osgood.)

Peromyscus m. argentatus (COPELAND & CHURCH). (Proc. Biol. Soc. Wash., XIX, 1906, p. 122.) Type locality — Grand Harbor, Island of Grand Manan, New Brunswick. Color more grayish than either *maniculatus* or *abietorum*.

Peromyscus m. nubiterræ (RHOADS). (Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 187.) Type locality — Summit of Roan Mountain, North Carolina, altitude 6370 feet. Similar to *gracilis*, but averaging smaller; tail longer than head and body.

Peromyscus gossypinus megacephalus (RHOADS).

WESTERN COTTON MOUSE.

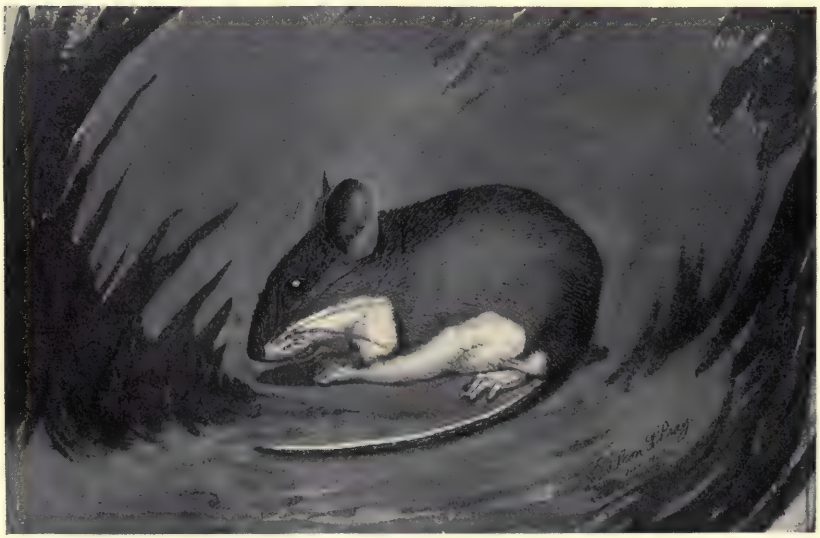
Sitomys megacephalus RHOADS, Proc. Acad. Nat. Sci. Phila., 1894, p. 254.

Peromyscus gossypinus mississippiensis RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 189.

Peromyscus gossypinus megacephalus OSGOOD, N. Amer. Fauna, No. 28, 1909, p. 138 (Tennessee, Arkansas, etc.). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 26 (Illinois and Missouri).

Type locality — Woodville, Alabama.

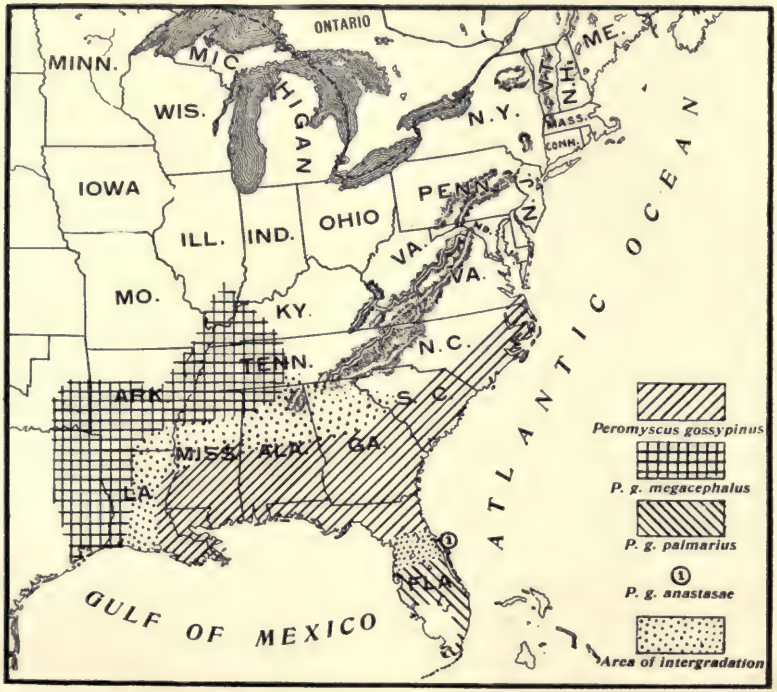
Distribution — Southern Illinois, western Kentucky and Tennessee, to northern Alabama, thence through northern Mississippi, eastern and southern Arkansas to Oklahoma, eastern Texas and western Louisiana.



Western Cotton Mouse (*Peromyscus gossypirus megacephalu*

Special characters — Largest species of the genus, which occurs within our limits; very similar to *P. leucopus*, but may be distinguished by size.

Description — Middle of back from crown to base of tail dark brown shading to cinnamon brown on the sides; under parts white or



Map illustrating approximate distribution of the Cotton Mice (*Peromyscus gossypinus* and races) in eastern United States.

Peromyscus gossypinus (LECONTE). (Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 411.) Type locality — LeConte Plantation near Riceboro, Liberty Co., Georgia. General color darker and size smaller than *megacephalus*. Does not occur within our limits.

Peromyscus g. megacephalus (RHOADS). Type locality — Woodville, Alabama. Similar to *gossypinus*, but slightly paler and larger. Description and measurements as previously given.

Peromyscus g. palmarius BANGS. (Proc. Biol. Soc. Wash., X, 1896, p. 124.) Type locality — Oak Lodge, east coast of Florida opposite Micco, Brevard Co. Smaller and paler than *gossypinus*.

Peromyscusg. anastasæ (BANGS). (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 195.) Type locality — Point Romo, Anastasia Island, near St. Augustine, Florida. About equal in size to *palmarius*, but palest of the group.

whitish, the hairs plumbeous gray at base and tipped with white; feet white; tail rather thinly haired, dark above, pale or whitish below.

Measurements — Total length, about 7.25 in. (184 mm.); tail vertebræ, 3.20 in. (79 to 83 mm.); hind foot, .96 in. (24 mm.).

The Western Cotton Mouse is not uncommon in southern Illinois. The Museum collection contains specimens from Ozark, Golconda, and Olive Branch, but thus far it has only been taken in the extreme southern portion of the state. Howell states that it is common in swamps and wooded bluffs of the Lower Austral Zone and that specimens were collected at Olive Branch, Wolf Lake and Golconda, Illinois, and also in Missouri. (*l. c.*, p. 26.) Rhoads, who observed this Mouse in Tennessee, writes, "So far as I have made its acquaintance in Tennessee, the Cane Mouse is solely a denizen of the 'bottom lands' of the Mississippi. At Samburg it confined its wanderings very closely to the immediate vicinity of Reelfoot Lake, and was abundant in the dense forest jungle that bordered its margin, seeming to prefer the lowest and wettest parts of the overflowed lands." (*l. c.*, p. 189.)

Specimens examined from Illinois:

Illinois — Ozark, Johnson Co., 7; Golconda, Pope Co., 2; Olive Branch, Alexander Co., 1 = 10.

Subgenus **OCHROTOMYS** Osgood.

"Ears bright ochraceous, same color as body; posterior palatine foramina nearer to interpterygoid fossa than to anterior palatine foramina; dentine spaces of molars mostly closed" (Osgood).

Peromyscus nuttalli aureolus (AUD. & BACH.).

SOUTHERN GOLDEN MOUSE.

Mus (*Calomys*) *aureolus* AUD. & BACH., Proc. Acad. Nat. Sci. Phila., I, 1841, p. 98.

Hesperomys nuttalli KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 87 (southern Illinois).

Peromyscus nuttalli aureolus OSGOOD, N. Amer. Fauna, No. 28, 1909, p. 225 (Missouri, Arkansas, etc.). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 549 (Illinois).

Type locality — Oak forests of South Carolina.

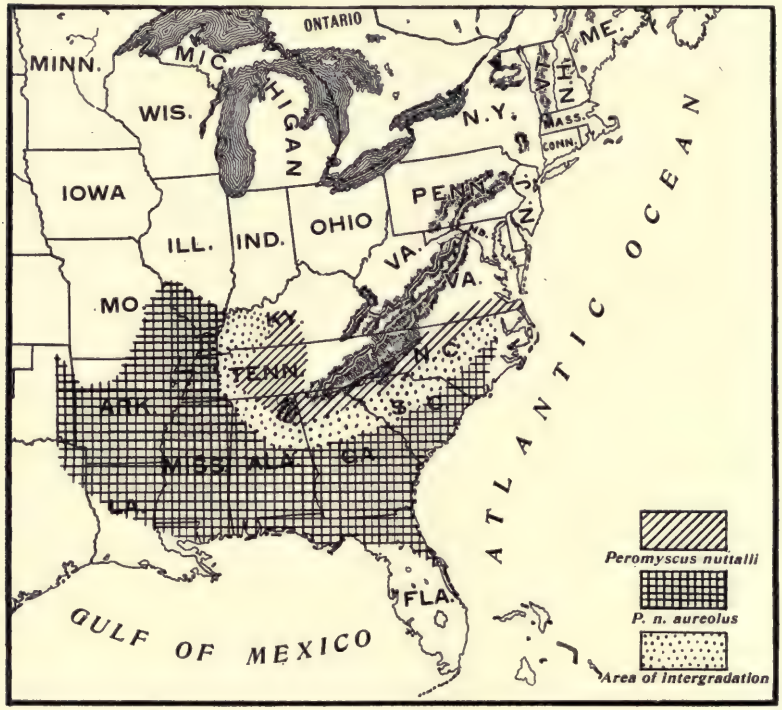
Distribution — Southeastern United States from northern Florida to North Carolina, west through the more southern portions of Georgia and Alabama, the whole of Mississippi, western Tennessee and western Kentucky, southern Illinois, southeastern Missouri and the greater portion of Arkansas and Louisiana to eastern Texas and Oklahoma.

Southern Golden Mouse (*Peromyscus nuttalli aureolus*).

Special characters — The golden brown color of the upper parts will readily distinguish it from others of the genus, which occur within our limits.

Description — Upper parts bright tawny brown or "golden brown," middle of the back tinged with darker brown; under parts cream white, often showing a faint tinge of tawny buff; hairs on under parts (except throat) with concealed bases plumbeous slate color, the tips white; face about the same color as sides, without any blackish marking; feet cream white; tail dark brown above, white beneath.

Measurements — Total length, 6.25 to 7 in. (158 to 178 mm.); tail vertebræ, 2.80 to 3.25 in. (70 to 82 mm.); hind foot, .75 in. (19 mm.).



Map illustrating approximate distribution of the Northern Golden Mouse (*Peromyscus nuttalli*) and the Southern Golden Mouse (*P. n. aureolus*).

Peromyscus nuttalli (HARLAN). (Month. Amer. Journ. Geol. & Nat. Sci., Phila., 1832, p. 446.) Type locality — Norfolk, Virginia. Similar to *aureolus*, but averaging larger, with somewhat larger skull and molar teeth. Total length, 6.87 to 7.50 in. (175 to 190 mm.); tail vertebræ, 3.25 to 3.65 in. (82 to 93 mm.).

Peromyscus n. aureolus (AUD. & BACH.). Type locality — Oak forests of South Carolina. Averaging smaller than *nuttalli*. Description as previously given. Total length, 6.25 to 7 in. (158 to 178 mm.); tail vertebræ, 2.80 to 3.25 in. (70 to 82 mm.). Occurs within our limits in southern Illinois.

The Southern Golden Mouse occurs within our limits in southern Illinois, where it is not uncommon in small growths of hard-wood timber bordering the cypress swamps. All the specimens in the Museum were taken near Olive Branch, Alexander Co. Kennicott secured specimens in Marion County, which is probably not very far from its northern limit. He says — "In some parts of Southern Illinois I found this species to be well known as distinct from the common deer-mouse, under the name of 'Red Mouse.' . . . I captured two at Murphysboro and it is not very uncommon near Salem, in Marion County. It is seldom found, if ever, in the northern part of this State.

"The red mouse appears to be strictly an inhabitant of the forest, like the deer-mouse (*Hesperomys leucopus*), to which it is closely allied in habits as in form. Farmers who had repeatedly observed this, as well as the deer-mouse, in the woods near Salem, inform me that they never heard of the red mouse on the prairie, though it frequented clumps of hazel bushes at the edges of the prairies. . . . The red mouse is more arboreal in its habits than the deer-mouse. I observed one, when driven from its nest, at once take refuge on a tree, instead of running off on the ground, and I am informed that these mice have frequently been seen climbing trees and shrubs. From a gentleman, of Salem, I learn that this, like the deer-mouse, builds nests in the branches of small trees, and that several were found in the tops of hazel bushes, and built neatly, somewhat like a bird's nest, but covered at top with a small opening on the side. . . . The only two specimens of this mouse which I have seen alive, were an old female and a half grown young one, found together in the month of May, in a slight nest formed of soft fibres of bark, and placed on the ground under a log. There was no burrow, either beneath or near the log, though the female had evidently reared her young in this nest. The species probably does not generally burrow at all." (*l. c.*, pp. 87–88.)

Specimens examined from Illinois:
Illinois — Olive Branch, Alexander Co., 22.

Reithrodontomys dychei ALLEN, DYCHE'S HARVEST MOUSE, while not as yet recorded from within our limits, may be looked for in southern and western Illinois, as it has been taken at St. Louis, Missouri (Allen, Bull. Amer. Mus. Nat. Hist., 1895, p. 121), and also at Fairport, Muscatine Co., Iowa, where Mr. T. Surber secured four specimens during the summer of 1910, which were kindly sent to me for examination. The following characters will readily distinguish this little Mouse from our other species:

Middle of back brown, sides *grayish buff;* under parts white; crowns

of molars tuberculate; *front of incisors with distinct longitudinal groove.* Total length, about 5 in. (120 to 130 mm.); tail vertebræ, 2 to 2.50 in. (50 to 65 mm.).

Genus **ORYZOMYS** Baird.

Oryzomys Baird, Mammals N. Amer., 1857, p. 458. Type *Mus palustris* Harlan.

Molars or grinding teeth with tubercles on crowns arranged in two rows; hair on tail scanty; skull showing a distinct ridge over eye socket; belly not white; hind feet large.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3}=16$.

Oryzomys palustris (HARLAN).

RICE FIELD MOUSE. RICE RAT.

Mus palustris HARLAN, Silliman's Amer. Jour. Sci. & Arts, XXXI, No. 2, 1837, p. 386.
Arvicola oryzivora AUDUBON & BACHMAN, Quadrupeds of N. Amer., III, 1854, p. 214.
Hesperomys (Oryzomys) palustris BAIRD, Mammals N. Amer., 1857, p. 459.
Oryzomys palustris MERRIAM, Proc. Wash. Acad. Sci., III, 1901, p. 276. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 640 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 26 (Illinois and Missouri). *Ib.*, p. 61 (Kentucky, Tennessee, etc.). VAN HYNING & PELLETT, Proc. Iowa Acad. Sci., XVII, 1910, p. 213 (Iowa).
Calomys palustris EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 139.

Type locality — Fast Land, near Salem, Salem Co., New Jersey.

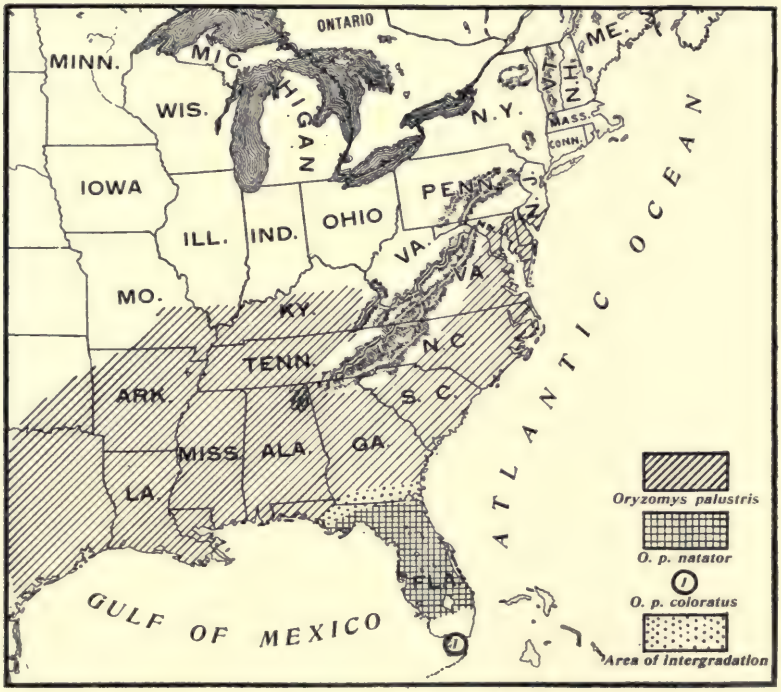
Distribution — Southern United States, from southern New Jersey to the northern border of Florida, westward throughout the Gulf states, Tennessee and part of Kentucky, southern Illinois and southern Missouri to Kansas, Oklahoma and eastern Texas.

Special characters — Readily distinguished from a *Peromyscus* by its long and more scantily haired tail, its large hind feet and decidedly less abrupt line of demarcation between color of sides and belly, which is gradual and not sharply defined, and from all other Rats or Mice which occur within our limits either by its size or by the arrangement of the tubercles on the crowns of the grinding teeth (two longitudinal rows). It occurs within our limits only in southern Illinois.

Description — Middle of upper parts from head to base of tail dark brown shading into pale brown tinged with buffy on the sides; under parts grayish, the hairs grayish plumbeous at the base and tipped with white, but the grayish under fur showing through; tail very scantily haired, dark above, pale below; feet whitish (pinkish white in life).

Measurements — (Average of 8 specimens from various localities.) Total length, 8.88 in. (225 mm.); tail vertebræ, 4.38 in. (111 mm.); hind foot, 1.15 in. (29.6 mm.).

The Rice Field Mouse occurs within our limits in southern Illinois, where Mr. Howell secured four specimens taken at Olive Branch, Alexander Co. In Louisiana and northwestern Florida, where I have taken it, it inhabits swampy places, hummocks, and old fields, but apparently never far from water, in which it is quite at home, being an expert swimmer. In such localities the nest is in a burrow in the ground, but Audubon and Bachman state that in extensive salt marshes they



Map illustrating the approximate distribution of Rice Field Mice or Rice Rats of the genus *Oryzomys* which occur in eastern United States.

Oryzomys palustris (HARLAN). Type locality — Fast Land, near Salem, Salem Co., New Jersey. Description as previously given.

Oryzomys p. natator CHAPMAN. (Bull. Amer. Mus. Nat. Hist., V, 1893, p. 44.) Type locality — Gainesville, Alachua County, Florida. Larger than *palustris* and tail longer; color more fulvous brown.

Oryzomys p. coloratus BANGS. (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 189.) Type locality — Cape Sable, Monroe Co., Florida. Larger than *natator;* color more reddish brown.

have found nests of this species suspended on a branch of interlaced marsh grass. (*l. c.*, p. 215.) According to Howell the species is particularly abundant in the marshes on the coast of Alabama. The young generally number from four to five and the majority are born in April.

Subfamily NEOTOMINÆ.

This is a small subfamily confined to North America. The molars are not tuberculate but the crowns have irregular enamel loops.

Genus **NEOTOMA** Say & Ord.

Neotoma Say & Ord., Jour. Acad. Nat. Sci. Phila., IV, Pt. 2, 1825, p. 345. Type *Mus floridanus* Ord.

Crowns of grinding teeth (molars) with irregular loops; first and second upper molars with middle enamel loops undivided (for illustration see p. 173.); third lower molar with two transverse enamel loops bullæ oblique and tapering anteriorly; eyes and ears large; tail covered with hair; size large for the family. Three subgenera are recognized, but only one of them, represented by a single species, occurs within our limits.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3} = 16$.

Subgenus **NEOTOMA** Say & Ord.

Tail covered with hair but not bushy; "maxillary toothrow much narrower posteriorly than anteriorly; middle lobe of last upper molar not divided by inner re-entrant angle" (Goldman).

Neotoma floridana illinoensis HOWELL.

ILLINOIS WOOD RAT.

Neotoma floridana illinoensis HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 28 (Union Co., southern Illinois). GOLDMAN, N. Amer. Fauna, No. 31, 1910, p. 23 (southern Illinois to northeastern Kansas).

Type locality — Wolf Lake, Union County, southern Illinois.

Distribution — Southern Illinois to northeastern Arkansas; limits of range not definitely known.

Special characters — Cranial characters resembling *floridana*, but with zygomata more abruptly spreading and with posterior border of palate emarginate; approaches *N. f. rubida* in size but general color grayer and tail more distinctly bicolor.

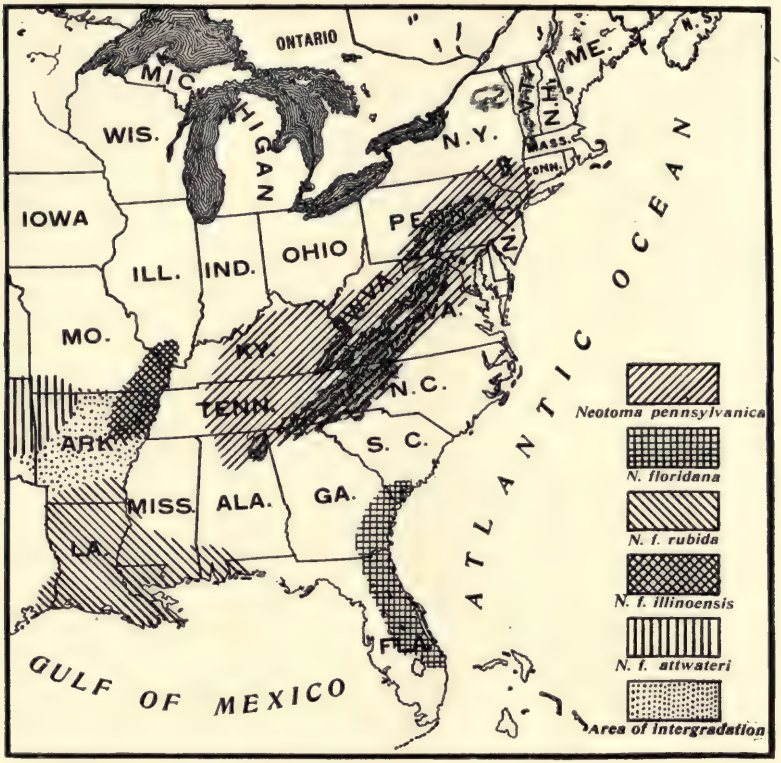
Illinois Wood Rat (*Neotoma floridana illinoensis*).

Description — Upper parts yellowish brown mixed with blackish hairs, darkest on crown; concealed portion of fur on upper parts dusky plumbeous; sides of body tawny brown or brownish buff; face and outer side of legs grayish; under parts white; feet white; tail dusky brown above, paler beneath.

Measurements — Total length, about 15.50 in. (393 mm.); tail vertebræ, 7.50 in. (190 mm.); hind foot, 1.50 in. (38 mm.); ear, 1 in. (25 mm.).

Average measurements of 6 topotypes in Field Museum collection: — Total length, 377 (363–396); tail vertebræ, 176 (167–190); hind foot, 38 (37–40).

Average measurements of 8 adults from the type locality as given by Howell in his original description — "Total length, 430 (390–435); tail vertebræ, 195 (187–205); hind foot, 38 (36–40)."



Map illustrating approximate distribution of Wood Rats (*Neotoma*) in eastern United States.

*Neotoma pennsylvanica** STONE. (Proc. Acad. Nat. Sci. Phila., 1893, p. 16.) Type locality — South Mountain, Cumberland Co., Pennsylvania. Total length about 16.50 in. (418 mm.); ears large; color dull brownish plumbeous, above mixed with black hairs; feet and under parts white; tail bicolor, above brown, under surface white; first upper molar with anterior inner notch or angle, deep, extending more than half way across the lobe.

Neotoma floridana (ORD). (Bull. Soc. Philom. Paris, 1818, p. 181.) Type locality — St. John's River, Florida. Smaller than *pennsylvanica* and more plumbeous, tail less thickly haired; skull slighter; first upper molar with anterior inner notch or angle, shallow, extending less than half way across the lobe.

Neotoma f. attwateri (MEARNS). (Proc. U. S. Nat. Mus., XIX, 1897, p. 721.) Type locality — Lacey's Ranch, Turtle Creek, Kerr Co., Texas. Similar to *floridana* but pelage longer and grayer in summer; tail less than 6⅞ in. (175 mm.).

* *Neotoma magister* BAIRD, described from lower jaws found in Pleistocene cave deposits near Carlisle, Pennsylvania (Baird, Mammals N. Amer., 1857, p. 498), is regarded by Goldman as distinct from *N. pennsylvanica* (N. Amer. Fauna, No. 31, 1910, p. 83).

Neotoma f. rubida BANGS. (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 185.) Type locality — Gibson, Terrebonne Parish, Louisiana. Larger than *floridana*, with larger hind feet; color of upper parts tinged with dark russet brown; tail not distinctly bicolor, dusky above, slightly paler beneath.

Neotoma f. illinoensis HOWELL. Type locality — Wolf Lake, Union Co., southern Illinois. Description as previously given. Differs from *rubida* in being somewhat lighter in color and tail more distinctly bicolor.

The Illinois Wood Rat was lately described by Mr. Arthur H. Howell, who first secured specimens near Wolf Lake, Union Co., southern Illinois, in May, 1909. By those unfamiliar with mammals it might be mistaken for a large House Rat, but it may readily be distinguished from that species (aside from its well-marked dental characters) by its hair covered tail, large ears, pure white under parts and white feet.

Regarding the habits of this Wood Rat, Mr. Howell says: "The animals are common at Wolf Lake, inhabiting the high rocky bluffs which border the east side of the lake. They live in crevices and caves into which they carry large quantities of sticks, leaves, and other rubbish. Their habits in this locality are thus like those of *N. pennsylvanica* and unlike those of *rubida* in the Southern States where this species lives in swamps and builds its nests in hollow logs or trees and in the branches of trees some distance from the ground. The swamp conditions were present at this northern station, but the adjacent cliffs evidently proved more attractive to them, as is usually the case with members of this genus. Three adults and one young, all in worn pelage, were captured at Wolf Lake, May 24, 25, and in January, 1910, eight more adults in full fresh pelage were secured by a local trapper." (*l. c.*, p. 28–29.)

Specimens of this Rat have also been taken in northeastern Arkansas (Goldman, *l. c.*, p. 23).

The specimen identified by Mr. F. E. Wood as *Neotoma floridana* from Havana, Illinois (Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 550), and preserved in the collection of the Illinois State University at Urbana, was kindly sent to me by Dr. S. A. Forbes for examination. It is an alcoholic specimen and proves to be a small female *Epimys norvegicus*, somewhat abnormal in color, probably due to its having been kept in alcohol for a considerable time.

Specimens examined from Illinois:

Illinois — Wolf Lake, Union Co., 6; (B. S.) Wolf Lake, Union Co., 2 = 8.

Subfamily MICROTINÆ.

A subfamily confined to the northern portions of the old and new worlds. The crowns of molars show irregular enamel loops or triangles.

Genus **EVOTOMYS** Coues.

Evotomys Coues, Proc. Acad. Nat. Sci. Phila., 1874, p. 186. Type *Mus rutilus* Pallas.

Skull narrow and slender; front teeth (incisors) without grooves; molars with pronged roots; crowns of molars with irregular triangles; tail comparatively short; middle of back (normally) reddish brown, in decided contrast to the color of the sides of body; mammæ 8.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3} = 16$.

Evotomys gapperi (VIGORS).

RED-BACKED MOUSE. RED-BACKED VOLE.

Arvicola gapperi VIGORS, Zool. Jour., V, 1830, p. 204. KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 88 (Wisconsin, Minnesota). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin).

Hypudæus rutilus var. *gapperi* HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 194 (Minnesota).

Evotomys gapperi BAILEY, Proc. Biol. Soc. Wash., XI, 1897, p. 122 (Minnesota, Ontario, etc.). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 116 (Dodge Co., Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 22 (Wisconsin).

Type locality — Vicinity of Lake Simcoe, Ontario.

Distribution — The Atlantic states from Pennsylvania northward and west along the northern border of the United States to Minnesota and in Canada to the Rocky Mountains.

Special characters — A broad rufous chestnut stripe on middle of back extending from the crown to the rump; sides of body grayish buff, sometimes with a slight olive tinge but always strikingly different from the color of the back; tail comparatively short.

Description — *Normal phase:* A broad stripe of rufous chestnut from the back of the head extends down middle of the back to the rump; sides of body and fore part of head and face grayish buff, sometimes faintly tinged with olive; a dusky mark at base of the whiskers; under parts ashy or whitish, often faintly tinged with buff; the bases

of the hairs on the under parts are dark plumbeous and the tips white or buffy white, the dark parts being nearly or quite concealed, but occasionally the under fur shows through, giving a gray tinge to the under parts; adults often have a patch of pale, sometimes whitish, fur surrounding the gland on the flank.

Dark phase: Occasionally specimens representing a dichromatic or dark phase of pelage are taken; the reddish brown back is replaced by dusky and the general coloration is darker and grayer. In the large number of specimens examined I have seen only one in this pelage from Wisconsin.

Measurements — (12 adult specimens from northern Wisconsin.) Total length, 5.10 to 6 in. (130 to 154 mm.); tail vertebræ, about 1.37 in. (30 to 41 mm.); hind foot, about .73 in. (18 to 20 mm.).

Remarks — The Museum series contains 25 apparently not fully adult specimens which are small, several having a total length of 118 to 125 mm., and are very similar in size and coloration to specimens of *E. g. loringi* from Dakota. Other specimens from the same locality, however, are of normal size. There is considerable variation in size of the adults of this species, as will be seen by the following measurements of 12 selected specimens from different localities in northern Wisconsin.

		Total Length.	Tail Vertebræ.	Hind Foot.
Spread Eagle, Florence Co....	♂	147 mm.	41 mm.	19 mm.
Spread Eagle, Florence Co....	♂	144 "	39 "	19 "
Conover, Vilas Co.....	♂	152 "	38 "	19 "
Conover, Vilas Co.....	♂	130 "	32 "	18.5 "
Conover, Vilas Co.....	♀	139 "	32 "	18.5 "
Lac Vieux Desert, Vilas Co...	♂	154 "	38 "	20 "
Lac Vieux Desert, Vilas Co...	♂	135 "	32 "	18 "
Lac Vieux Desert, Vilas Co...	♀	153 "	39 "	19 "
Lac Vieux Desert, Vilas Co...	♀	142 "	34 "	18 "
Lac Vieux Desert, Vilas Co...	♀	134 "	30 "	18 "
Upper St. Croix Lake, Douglas Co.....	♂	137 "	32 "	18 "
Upper St. Croix Lake, Douglas Co.....	♀	149 "	38 "	18.5 "

The Red-backed Mouse is a woodland species, frequenting low ground in heavy timber, sphagnum bogs and banks of streams, although like many other species of similar habitat, it occasionally resorts to fields and pastures bordering the woods. It is more diurnal in its habits than others of our Mice and is not uncommonly to be seen running about in the day time.

It is found in favorable localities throughout the greater part of Wisconsin except, perhaps, in some of the extreme southern and south-

Red-backed Mouse (*Evotomys gapperi*).

western counties. Mr. Snyder has a specimen in his collection from Dodge Co., and there is a specimen in the collection of Dr. H. V. Ogden, taken at Oak Creek, Milwaukee Co., but according to Jackson, in the interior of the state it is rarely found south of Columbia Co. (*l. c.*, p. 22.) It has not been recorded from Illinois.

Regarding the habits of this species Dr. C. Hart Merriam writes: "The Wood Mouse is terrestrial, like the other members of the *Arvicoline* series, and commonly lives in burrows in the ground. It sometimes makes regular runways similar to those of the field mouse, but usually travels freely over the surface, not confining itself to any prescribed course. It is both diurnal and nocturnal. I have shot it at noonday, scampering over the leaves in the deep woods, and dodging in and out between the rocks of a lake shore. I have also seen it after dark in shanties and in log-houses; and have caught many during the night in traps baited with beech nuts and meat. Its ordinary gait is a moderately fast trot; I have never seen it proceed in leaps. Still, it runs swiftly for a short distance and its quick movements render it difficult to capture.

"The nest of the Red-backed Mouse is usually, in this region, placed in a burrow in the earth, though it is sometimes found in a half decayed log, or under the roots of a stump. I have shot females, each

containing four young, as early as the 3rd of April, and as late as the 4th of October. I have also taken a female early in June that was nursing her second brood. Hence it is clear that several litters are produced in a season.

"The flesh of the Red-backed Mouse is tender and well flavored."*

Kennicott in describing the habits of this mouse says: "I captured a number of this species, which, with several deer-mice (*Hesperomys leucopus*) came into a shanty to feed upon some rice which lay in bags on the floor. These Arvicolæ never having been injured, were quite tame, and ran about the room without much regard for the presence of the occupants. In feeding, they sat upon the hind feet and haunches, in the manner of the Arvicola austerus, holding the grains of rice with the fore-paw, and sometimes grasping a grain in one paw only. . . . In climbing, they surpassed all other meadow-mice, running up the corners of the shanty to the roof, and over the rough logs as if perfectly at ease. In the woods, too, I found a nest in the rotten stub of a tree, several feet from the ground. They never moved by leaps, but trotted with graceful gliding movement, like the Arvicola austerus. I was particularly struck by their diurnal habits. . . . I sought in vain for any indications of regular pathways under the leaves or grass, like those of our other species, and was finally induced to believe that it constructed none.

"I found a number of the nests of the red-backed meadow-mice, and, with the exception of one placed in a stump, they were all situated on the top of the ground, under logs. They were slightly formed of a small quantity of soft leaves and grass. . . . The Arvicola Gapperi is, apparently, very prolific. I found eight young in a nest and within several rods of this a family of five or six, probably a month or two older, and which I concluded to be an earlier litter of the same parent." (*l. c.*, pp. 89–90.)

Specimens examined from Wisconsin:

Wisconsin — Solon Springs, Douglas Co., 25; Sayner, Vilas Co., 10; Conover, Vilas Co., 5; Lac Vieux Desert, Vilas Co., 7; Spread Eagle, Florence Co., 4; (M. P. M.) Burnett Co., 4; Douglas Co., 2; Marinette Co., 2; Vilas Co., 2; (O. C.) Fisher Lake, Iron Co., 13; Oak Creek, Milwaukee Co., 1; (S. C.) Beaver Dam, Dodge Co., 1; = 76.

* Mamm. Adirondack Reg., 1886, p. 271–72.

Map illustrating approximate distribution of Red-backed Mice or Red-backed Voles (*Evotomys*) in eastern United States.

Evotomys gapperi (VIGORS). Type locality — Vicinity of Lake Simcoe, Ontario. Description as previously given.

Evotomys g. loringi BAILEY. (Proc. Biol. Soc. Wash., XI, 1897, p. 125.) Type locality — Portland, Traill County, North Dakota. Smaller and somewhat brighter colored than *gapperi* and with smaller skull.

Evotomys g. ochraceus MILLER. (Proc. Bost. Soc. Nat. Hist., XXVI, 1894, p. 193.) Type locality — Mt. Washington, Coos Co., New Hampshire. Larger and darker than *gapperi*.

Evotomys g. rhoadsi STONE. (Amer. Nat., XXVII, 1893, p. 55.) Type locality — May's Landing, Atlantic Co., New Jersey. About the size of *gapperi*, but darker and with shorter tail.

Evotomys proteus BAILEY. (Proc. Biol. Soc. Wash., XI, 1897, p. 137.) Type locality—Hamilton Inlet, Labrador. Largest of our northeastern forms.

Evotomys carolinensis MERRIAM. (Amer. Jour. Sci., 3rd ser., XXXVI, 1888, p. 460.) Type locality — Roan Mountain, Mitchell Co., North Carolina (altitude 6,000 ft.). Dorsal stripe dark chestnut and not sharply defined, shading into color of sides.

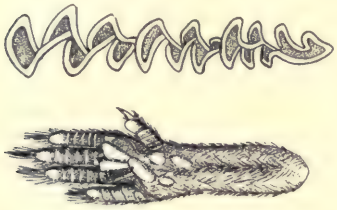
Genus **MICROTUS** Schrank.

Microtus Schrank, Fauna Boica, I, 1798, p. 72. Type *Microtus terrestris* Schrank = *Mus arvalis* Pallas (by elimination).

Form thick set; tail short; ears short; lower incisors extending in jaw back of molars; molars without pronged roots; crowns of molars with irregular triangles or loops; plantar tubercles (wart-like excrescences on sole of foot) 4 to 6.

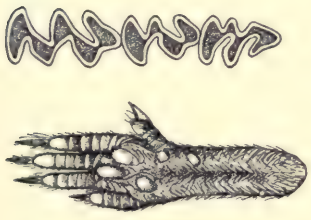
Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3} = 16$.

Three recognized subgenera are represented within our limits, which may be characterized as follows in our species:



Crowns of upper molars and sole of foot.

A. Plantar tubercles 6.
Crown of third upper molar with five or more irregular loops, the middle ones forming three closed triangles; mammæ 8 in our species, 4 pectoral and 4 inguinal.
Subgenus MICROTUS, p. 214.



B. Plantar tubercles 5.
Crown of third upper molar with 4 irregular loops, the middle ones forming two closed triangles; mammæ 6, 4 inguinal, 2 pectoral; skull narrow and high.
Subgenus PEDOMYS, p.218.
Crown of third upper molar with 4 irregular loops, the middle ones forming two closed triangles; mammæ 4, inguinal; skull flat and wide. Subgenus PITYMYS, p. 222.

FIELD KEY TO OUR SPECIES.

A. Total length more than 5.50 inches; tail more than 1.10 inches long.
Upper parts more or less grizzly brown; under parts buffy gray or pale brownish gray; tail usually *less* than 1.60 inches long; plantar tubercles 5; mammæ 6.
PRAIRIE MEADOW MOUSE OR VOLE.
Microtus ochrogaster, p. 218.

Upper parts brown, but lacking the "grizzly" appearence of *M. ochrogaster;* under parts slaty plumbeous, often with a slight wash of cinnamon; tail usually *more* than 1.60 inches long; plantar tubercles 6; mammæ 8 (in our species).
MEADOW MOUSE OR VOLE.
Microtus pennsylvanicus, p. 214.

B. Total length less than 5.50 inches; tail 1 inch or less long.
Upper parts dark chestnut brown; under parts plumbeous gray, more or less tinged with buff; fur soft, suggesting that of a mole; plantar tubercles 5; mammæ 4; claws on fore feet longest.

MOLE MOUSE or MOLE-LIKE VOLE.
Microtus pinetorum scalopsoides, p. 222.

Subgenus **MICROTUS** Schrank.

Plantar tubercles 6; crown of third upper molar with 5 or more irregular loops, the middle ones forming three closed triangles; mammæ 8 in our species, 4 pectoral and 4 inguinal.

Microtus pennsylvanicus (ORD).

MEADOW MOUSE. MEADOW VOLE.

Mus pennsylvanica ORD, Guthrie's Geography, 2nd Amer. ed., II, 1815, p. 292.

Arvicola riparius, LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). KENNICOTT, Trans. Ill. State Agr., Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 104 (Illinois). MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 221 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 193 (Iowa). COUES, Monog. N. Amer. Rodentia, 1877, p. 165 (Illinois, Wisconsin, Missouri, etc.). OSBORN, Proc. Iowa Acad. Sci. I, 1887–89 (1890), p. 43 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin).

Microtus pennsylvanicus RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 185 (Tennessee). BAILEY, N. Amer. Fauna, No. 17, 1900, p. 16 (Michigan, Illinois, Wisconsin, Missouri, Iowa, Minnesota, etc.). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 117 (Wisconsin). HAHN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 459 (Kankakee Valley, Indiana). LANTZ, U. S. Dept. Agr., Biol. Surv., Bull. No. 31, 1907, p. 15. MCATEE, Proc. Biol. Soc. Wash., XX, 1907, p. 5 (Munroe Co., Indiana). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 22 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 506 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 29 (Kentucky).

Type locality — Meadows below Philadelphia, Pennsylvania.

Distribution — Northeastern United States, from northern border of Quebec and Ontario to Virginia and in the mountains of North Carolina and Tennessee west to Nebraska, Minnesota and South Dakota. Occurs throughout about the northern two-thirds of Illinois and the whole of Wisconsin.

Description — Upper parts dark chestnut brown, at times ochraceous chestnut; the fur on back mixed with blackish hairs; sides of body lighter than back; under parts slaty plumbeous, occasionally with a slight wash of pale cinnamon brown; feet brownish; tail dark above, somewhat paler below; other characters as given for the subgenus.

Measurements — Total length, about 6.50 in. (150 to 180 mm.); tail vertebræ, about 1.75 in. (45 mm.); hind foot, .88 in. (22 mm.).
Habitat — Fields, meadows and swamps.

The Meadow Mouse is common throughout northern Illinois and Wisconsin in low meadows, marshes, and wooded swamps; but it is also found in dry pastures and corn fields, especially in the autumn. Its exact southern range in Illinois has not been definitely determined but it probably does not extend much beyond the south central portion of the state. Wood records it from McLean Co., Illinois (*l. c.*, p. 551). Coues mentions specimens from St. Louis, Missouri, and Hahn, from Munroe and Ohio counties, Indiana, which are the most southern records in the western portion of its range that I have been able to find.

This Mouse is not uncommonly seen running about in the daytime and it is more diurnal in its habits than most of its kind. Two or three litters are born in a season and the young number from 5 to 8, generally 5 or 6. The nest is usually in burrows in tussocks of grass above the damp ground and is constructed of grass and pieces of weeds, the interior being lined with some soft substance, such as the pappus of milkweed or cat-o'-nine-tails. The entrance is a hole on one side near the

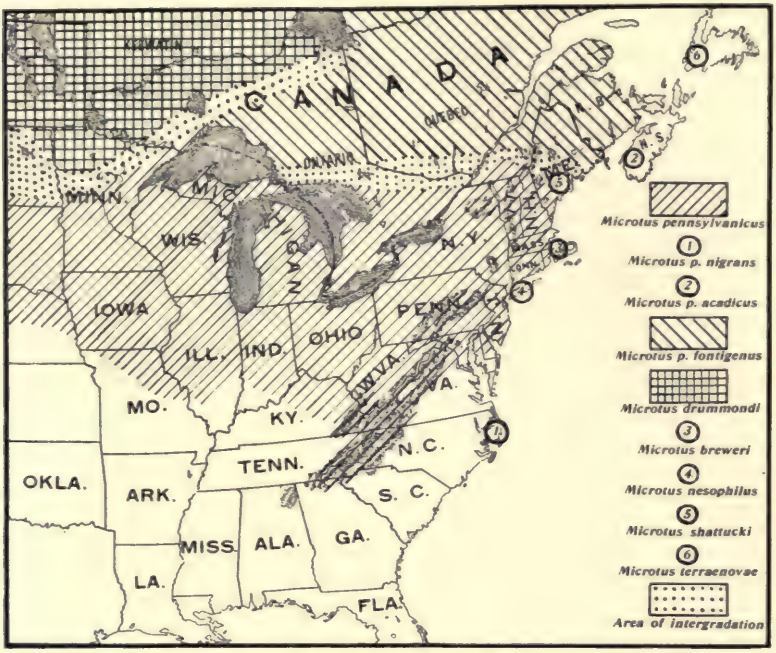
Meadow Mouse or Meadow Vole (*Microtus pennsylvanicus*).

bottom. In summer its food mainly consists of the roots of grass and weeds. Lantz states (*l. c.*, p. 17) that it is very fond of the roots of the wild, white morning-glory (*Convolvulus sepium*). In fall and winter it eats seeds, grain and the bark of trees, and it often does considerable injury to fruit orchards. I have often seen them sit up on their haunches and eat their food, holding it in their fore paws after the manner of a Squirrel. They do not hibernate in winter but pass most of their time in runways beneath the snow, and it is claimed they store up more or less food for use during the cold weather.

Lantz says, "The habit of storing food seems to be less common in this country than with Old World species, but it is far from rare. Caches of food are often found, which show that in times of abundance the animals store away more than is needed for immediate use." (*l. c.*, p. 14.)

Dr. C. Hart Merriam in describing the habits of this species says:* "In the beginning of winter, when the ground is frozen for some distance below the surface, it abandons its burrows and lives entirely above ground. Its nests of dry grass then lie flat upon the surface, without attempt at concealment, and are soon buried in the snow. As winter advances and the snow becomes deeper, the Meadow Mice regularly betake themselves to their nests for rest. The heat from their bodies soon melts the snow in contact with and immediately adjoining the nests, which, from the continued operation of the same cause, come to be surrounded by slowly-growing, dome-shaped chambers. These increase in size until the spring thaws, in March and April, melt away their roofs, thus admitting the light and cold. They are then deserted. During snow-shoe tramps over fields at this season I have often noticed holes, from a few inches to a foot in diameter, appearing as if sharply cut in the surface. On inspection, they invariably proved to be the summits of these dome-shaped cavities, and a nest was always found at the bottom of each, surrounded by a zone of bare ground. They ranged from one to two feet (approximately 300 to 600 mm.) in diameter, and most of them were two feet in height. From the bottom of each chamber numerous runways and burrows penetrated the snow in all directions. Some followed along directly upon the ground, while others sloped upward at various angles. Many ran horizontally at varying levels, resting upon the dense strata that indicated the surface lines at different times during the winter. Near each nest was one or more burrows that reached the surface and contained considerable accumulations of the animal dejections. These seemed to be watch holes where the Mice came regularly to look at the prospect outside."

* Mamm. Adirondack Reg., 1886, p. 272.



Map illustrating approximate range of the Meadow Mouse (*Microtus pennsylvanicus*), together with the type localities of the species and subspecies belonging to the genus.

Microtus pennsylvanicus (ORD). Type locality — Meadows below Philadelphia, Pennsylvania. Description as previously given.

Microtus p. nigrans RHOADS. (Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 307.) Type locality — Currituck, North Carolina. Slightly larger and darker than *pennsylvanicus*; hind feet larger.

Microtus p. acadicus BANGS. (Amer. Nat., XXXI, 1897, p. 239.) Type locality — Digby, Nova Scotia. Smaller than *pennsylvanicus* and somewhat paler.

Microtus p. fontigenus (BANGS). (Proc. Biol. Soc. Wash., X, 1896, p. 48.) Type locality — Lake Edward, Quebec. Smaller than *pennsylvanicus*, with skull shorter and wider; bullæ large.

Microtus drummondi (AUD. & BACH.). (Quadrupeds of N. Amer., III, 1854, p. 166.) Type locality — Vicinity of Jasper House, Alberta, Canada. Paler, smaller and more slender than *pennsylvanicus*.

Microtus terrænovæ (BANGS). (Proc. Biol. Soc. Wash., IX, 1894, p. 129.) Type locality — Codroy, Newfoundland. Slightly larger than *pennsylvanicus*, with larger hind feet; color more yellowish; a median line on belly.

Microtus breweri (BAIRD). (Mammals N. Amer., 1857, p. 525.) Type locality — Muskeget Island, Massachusetts. Paler and grayer than *pennsylvanicus;* size somewhat larger.

Microtus nesophilus BAILEY. (Science, N. Ser., VIII, 1898, p. 783.) Type locality — Great Gull Island, New York. Darker than *pennsylvanicus;* skull shorter and wider.

Microtus shattucki (HOWE). (Proc. Port. Soc. Nat. Hist., II, 1901, p. 201.) Type locality — Tumble Down Dick Island, Dark Harbor, Penobscot Bay, Maine. Similar in color to *pennsylvanicus* but larger.

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Fox Lake, 19; Camp Logan, 2; Chicago, 2; Galena, 4 = 27.
Wisconsin — Sayner, 21; Solon Springs, 7; Beaver Dam, 69; Spread Eagle, 4; Conover, 2; Lake Koshkonong, 1; (M. P. M.) Pewaukee, 3; North Milwaukee, 24; Newport, Door Co., 1; Mouth of Yellow River, 5; Prescott, 7; Gordon, Douglas Co., 1; Nagawicka Lake, 3; Kelley Brook, Oconto Co., 3; Fountain City, 1; Maiden Rock, 1; Prescott, Pierce Co., 51; Prairie du Sac, Sauk Co., 21; (O. C.) Fisher Lake, Iron Co., 11; Whitefish Bay, Milwaukee Co., 1; Saxeville, Waukesha Co., 1; Milwaukee, 4 = 242.
Indiana — La Porte, 4.
Iowa — Knoxville, 2; Luxemburg, 3 = 5.
Michigan — Dowagiac, Cass Co., 5.

Microtus xanthognathus (Leach), Yellow-nosed Vole, was recorded by Lapham from Wisconsin (Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340), but the record was based on Hoy's notes and is undoubtedly an error. The known range of this species extends from Alberta, Canada, north and west to the Arctic coast and Alaska.

Subgenus **PEDOMYS** Baird.

Plantar tubercles 5; crown of third upper molar showing 4 irregular loops, the middle ones forming 2 closed triangles; mammæ 6, 4 inguinal and 2 pectoral; skull narrow and high. For illustrations of teeth and foot, see page 213.

Microtus ochrogaster (Wagner).

Prairie Meadow Mouse. Prairie Vole.

H[ypudæus] ochrogaster Wagner, Schreber's Säugthiere, Suppl., III, 1843, p. 592.
Arvicola hirsutus Lapham, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin).
Arvicola austerus Kennicott, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 97 (Illinois). Coues, Monog. N. Amer. Rodentia, 1877, p. 213 (Illinois, Wisconsin, Missouri, etc.). Strong, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin). Evermann & Butler, Proc. Ind. Acad. Sci., 1893 (1894), p. 127 (Indiana).
Microtus austerus Bailey, N. Amer. Fauna, No. 17, 1900, p. 73 (Wisconsin, Illinois, Indiana, Iowa, Missouri, etc.). Snyder, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 118 (Wisconsin). McAtee, Proc. Biol. Soc. Wash., XX, 1907, p. 6 (Indiana). Van Hyning & Pellett, Proc. Iowa Acad. Sci., XVII, 1910, p. 213 (Iowa).
Microtus (Pedomys) ochrogaster Allen, Bull. Amer. Mus. Nat. Hist., X, 1898, p. 459.
Microtus ochrogaster Osgood, Proc. Biol. Soc. Wash., XX, 1907, p. 48. Jackson, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 23 (Wisconsin). Jackson, Proc. Biol. Soc. Wash., XX, 1907, p. 73 (S. W. Missouri). Hahn, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 509 (Indiana). Howell, Proc. Biol. Soc. Wash., XXIII, 1910, p. 29 (Illinois, Missouri).

Type locality — Uncertain, probably Mississippi Valley.*

Distribution — From southern Wisconsin southward nearly throughout Iowa, Illinois, Indiana, Missouri, eastern Nebraska and Kansas, to northeastern Oklahoma.

Special characters — This species may be distinguished from *M. pennsylvanicus* by its "grizzly" upper parts and different color of belly; also characters previously given for the subgenus.

Description — Upper parts having a grizzly appearance of mixed light and dark brown; sides of body paler; under parts buffy gray or pale brownish gray; feet brown; upper surface of tail dark, under surface pale; more or less dusky or blackish about the nose; plantar tubercules 5.

Measurements — Total length, about 6 in. (152 mm.); tail vertebræ, about 1.30 in. (35 mm.); hind foot, .80 in. (20 mm.).

Habitat — High prairie land and dry fields; common in hazel thickets.

The Prairie Meadow Mouse is common throughout Illinois and more or less so in southern Wisconsin. I have seen no specimens from Wisconsin, but there are several in the Field Museum collection from extreme northern counties in Illinois (Jo Daviess and Lake). Jackson considers it locally common in Wisconsin in the extreme southern and western counties. Snyder records it from Beaver Dam, Dodge Co., and Bailey from Racine. Strong gives it as "quite abundant in the prairie regions of southern and central (*sic*) Wisconsin" (*l. c.*, p. 439).

Unlike the common Meadow Mouse this species prefers the dry fields and overgrown pastures and it is commonly found in cultivated clover and alfalfa fields. While their food consists principally of roots of grasses and weeds, they eat considerable grain and in late fall and winter they often do serious damage to fruit trees by attacking the roots. In the fall I have often found them under old corn shocks in corn fields. The nest resembles that of *M. pennsylvanicus*, but is somewhat smaller. Several litters are born in a year and the young usually number 4 or 5, rarely 6.

Robert Kennicott gives an interesting account of the habits of this species in Illinois. He says: "Their winter burrows on the uncultivated prairie are often in old ant-hills, or, if not, the earth thrown out of them forms little hillocks. They are not very deep, seldom over six inches or a foot, but are remarkable for the numerous and complicated chambers and side-passages of which they are composed. In one of these chambers, considerably enlarged, is placed the nest, formed of fine, dry grass. It is globular, from four to six inches in diameter, and with but a small cavity in the centre, which is entered by a very narrow

* See Osgood, Proc. Biol. Soc. Wash., XX, 1907, p. 48.

Prairie Meadow Mouse or Prairie Vole (*Microtus ochrogaster*).

opening on one side. This burrow and nest are occupied in winter, and in it at least the first litter of young is produced in the spring; but, in the summer and fall, these meadow-mice may be found in similar nests in the grass above ground, in which the young are often, if not usually, brought forth. Nests formed under the snow in winter are also occupied by them. From the burrows, innumerable runways traverse the neighborhood, intersecting those from other burrows, thus forming a complete net-work so that often scarcely a square yard can be found in an acre not crossed by one or more of these tracks. The runways of one pair may sometimes be traced five or ten rods on every side. These roads are not only formed for use in winter, when the ground is covered with snow, but are also employed as highways in summer. They are made above ground by pressing down and gnawing off the grass, and the earth is often worn quite smooth and bare in those most used. The inhabitants can travel easily along them at all times, in search of food, being well concealed by the overarching grass. In winter, these paths are formed on the ground, under the snow, as well as in the grass. The mice do not inhabit prairie pastures, where the grass is eaten close and affords them no cover.

"Upon examining, in November, the burrow of a pair of these meadow-mice, situated on the wild prairie, I found the excavation to have been recently enlarged. The nest was placed near the centre of

Map illustrating approximate distribution of the Prairie Meadow Mouse (*Microtus ochrogaster*) and allied forms belonging to the subgenus *Pedomys*.

Microtus ochrogaster (WAGNER). Type locality — Uncertain — "Mississippi Valley." Description as previously given.

Microtus o. ludovicianus (BAILEY). (N. Amer. Fauna, No. 17, 1900, p. 74.) Type locality — Iowa, Calcasieu Parish, Louisiana. Very slightly different from *ochrogaster*. It is supposed to differ in having audital bullæ larger and rostrum and nasals more slender.

Microtus minor (MERRIAM). (Amer. Nat., XXII, 1888, p. 600.) Type locality — Bottineau, base of Turtle Mountains, North Dakota. Similar in coloration to *ochrogaster*, but decidedly smaller, the skull smaller and narrower. Total length, about 5.25 in. (133 mm.); tail vertebræ, 1.37 in. (35 mm.); hind foot, .63 in. (16 mm.). Not as yet recorded from within our limits, but might be looked for in northwestern Wisconsin.

the burrow; and at one side, and in the deepest part of the excavation, was the store of winter provisions. This consisted of 5 or 6 quarts of roots, chiefly the round tubers of two species of spike-flowers (liatris), which grow abundantly in the vicinity, with a few roots of helianthus, and of various grasses, and several bulbs of wild onions." (*l. c.*, pp. 98–99.)

Kennicott also states that in confinement they were practically omnivorous and very pugnaceous; two males which he placed in a cage fought savagely and one killed and partly devoured the other. Several others, which he had in captivity, ate an astonishing amount of food, including corn, carrots, fresh meat and almost anything offered them. He also says: "They drank a great deal of water, soon perishing when left long without it, or some moist food." (*l. c.*, p. 100.)

Specimens examined from Illinois and adjoining states:

Illinois — Golconda, Pope Co., 7; Rosiclare, Hardin Co., 15; Fox Lake, Lake Co., 6; Galena, Jo Daviess Co., 2; Olive Branch, Alexander Co., 22; Ozark, Johnson Co., 1; Reevesville, Johnson Co., 2 = 56.
Indiana — La Porte, 2.
Iowa — Knoxville, 3.

Microtus minor MERRIAM, LITTLE MEADOW MOUSE OR LITTLE VOLE. It is not unlikely that this form may occur in northwestern Wisconsin, as it has been recorded from eastern Minnesota. It may be distinguished from *ochrogaster* by its small size and smaller and narrower skull. A sixth tubercle on hind foot is usually present, though small. The Field Museum collection contains specimens from Fort Snelling, Minnesota.

Subgenus **PITYMYS** McMurtrie.

Plantar tubercles 5; crown of third upper molar showing 4 loops, the middle ones forming 2 closed triangles; mammæ 4, inguinal; skull flat and wide. For characters distinguishing other subgenera, see page 213.

Microtus pinetorum scalopsoides (AUD. & BACH.).

MOLE MOUSE. MOLE PINE MOUSE. MOLE-LIKE VOLE.

Arvicola scalopsoides AUD. & BACH., Proc. Acad. Nat. Sci. Phila., I, 1841, p. 97. KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 102.

Arvicola kennicotti BAIRD, Mammals N. Amer., 1857, p. 547 (Illinois).

Arvicola pinetorum EVERMANN & BUTLER (part), Proc. Ind. Acad. Sci., 1893 (1894), p. 127 (Indiana).

Microtus pinetorum scalopsoides BAILEY, N. A. Fauna, No. 17, 1900, p. 64 (Indiana, Illinois, etc.). LANTZ, U. S. Dept. Agr., Biol. Surv., Bull. No. 31, 1907, p. 19. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 516 (Indiana).

Mole Mouse (*Microtus pinetorum scalopsoides*).

Type locality — Long Island, New York.

Distribution — From southern New York to North Carolina on the Atlantic coast and to northern Georgia in the interior, west through part of Kentucky and the greater portion of Indiana and Illinois to the Mississippi River.

Special characters — Total length less than 5.50 inches; tail short, less than one inch long; ears small; fur soft, suggesting that of a Mole; claws on front feet longest.

Description — Upper parts dark chestnut brown, paling slightly on sides; under parts plumbeous gray, more or less tinged with buff; tail brown above, paler beneath; feet light brown.

Measurements — Total length, 4.90 in. (125 mm.); tail vertebræ, .88 in. (22 mm.); hind foot, .67 in. (17 mm.).

The Mole Mouse or Mole-like Vole is an inhabitant of the woods, but it also frequents adjacent overgrown fields. It constructs underground tunnels just beneath the surface, which are marked by ridges of loose soil, resembling those made by a Mole but smaller. The nest is generally built on the ground under old logs or piles of brush, although it is sometimes in a burrow which is deeper than the runways. The young are usually 3 or 4 and several litters are born in a season. The food consists principally of roots, both of wild and cultivated plants,

Map illustrating approximate distribution of Pine Mice belonging to the subgenus *Pitymys*.

Microtus pinetorum (LECONTE). (Ann. Lyc. Nat. Hist. N. Y., III, 1830, p. 133.) Type locality — Pine forests of Georgia. General color cinnamon or russet brown; belly dusky, more or less tinged with russet brown; tail short; ears very small. Total length, about 4.50 inches; tail vertebræ, .70 inch.

Microtus p. scalopsoides (AUD. & BACH.). (Proc. Acad. Nat. Sci. Phila., I, 1841, p. 97.) Type locality — Long Island, New York. Larger and darker than *pinetorum*. Description as previously given.

Microtus p. auricularis BAILEY. (Proc. Biol. Soc. Wash., XII, 1898, p. 90.) Type locality — Washington, Adams Co., Mississippi. About equal in size to *pinetorum*, but color approaching *scalopsoides;* fur thick and dense.

Microtus nemoralis (BAILEY). (Proc. Biol. Soc. Wash., XII, 1898, p. 89.) Type locality — Stilwell (Boston Mountains), Indian Territory. Largest of the subgenus and coloration somewhat lighter than *scalopsoides*.

and it often does considerable damage in the garden, as it is fond of vegetables such as carrots and potatoes. In localities where it is at all common it is destructive to fruit trees. Kennicott states that while their food consists largely of roots of grass and other plants, he has found acorns and hazel-nuts in their burrows.

The exact range of the Mole Mouse in Illinois is uncertain. Bailey records it from West Northfield, Cook Co., and from Warsaw, Hancock Co. Kennicott states it was common in northern Illinois and southern Wisconsin, but the latter statement at least is questionable, as so far as I am aware there is no actual record of its having been taken in Wisconsin. Wood failed to find it in Champaign Co. and doubts that it is found there. The most northern record I have been able to find of its occurrence in Indiana is that given by Evermann and Butler from Wabash Co.* (*l. c.*, p. 127.) It is common, however, in southern Illinois. The Field Museum collection contains specimens from Johnson, Alexander and Hardin counties.

Specimens examined from Illinois:

Illinois — Olive Branch, Alexander Co., 11; Rosiclare, Hardin Co.,1; Reevesville, Johnson Co., 2 = 14.

Genus **FIBER** Cuvier.

Fiber Cuvier, Tabl. Elém. de Hist. Nat. des Anim., 1798, p. 141. (Described in 1798, but not named until 1800) *Ib.*, Leçons d'Anat. Comp., I, 1800, tab I. Type *Castor zibethicus* Linn.

Body short and thickly furred; tail bare and vertically compressed (width decidedly less than height); toes of hind feet partly webbed; molars or grinding teeth with pronged roots; lower incisors with roots on outside of molars; auditory meatus with protruding edge.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3} = 16$.

Fiber zibethicus (LINN.).

MUSKRAT.

Castor zibethicus LINNÆUS, Syst. Nat., XII ed., I, 1766, p. 79.

Fiber zibethicus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 105 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Mich-

* Given as *pinetorum* by Evermann & Butler, but which I assume to be this race.

igan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 194 (Iowa). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). BRAYTON, Geol. Surv. Ohio., IV, Pt. 1, 1882, p. 153 (Illinois, etc.). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 439 (Wisconsin). MERRIAM, Mamm. Adirondack Reg., 1886, p. 275. EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 126 (Indiana). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 6 (Kentucky). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 186 (Tennessee). MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 11 (North Shore, Lake Superior). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 121 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129 (Michigan). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 73 (S. W. Missouri). MCATEE, Proc. Biol. Soc. Wash., XX, 1907, p. 5 (Munroe Co., Indiana). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 517 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 62 (Tennessee, Mississippi. etc.). *Ib.*, XXIII, 1910, p. 29 (Illinois, Missouri, Kentucky).

Type locality — Eastern Canada.

Distribution — Eastern United States and southeastern Canada, south to northern North Carolina and northern Georgia and west to eastern Nebraska and Kansas. Replaced farther west and in the South by allied forms.

Description — General color dark chestnut brown above; under parts brownish white; fur of back and rump mixed with long, blackish brown hairs; throat whitish; chin with brown spot; feet brown, the claws horn color; tail black, nearly bare and flattened, vertically being considerably higher than wide. Freaks of color often occur; black specimens are not uncommon and partly white or entirely white individuals are occasionally taken.

Measurements — Size somewhat variable, generally 19 to 23 inches long. The following measurements probably represent an average specimen: Total length, 21.50 in. (546 mm.); tail vertebræ, 10.50 in. (266 mm.); hind foot, 3.30 in. (86 mm.).

Remarks — Cases of albinism, either complete or in part, are not uncommon. About three years ago Mr. W. S. McCrea of Chicago, called my attention to a series of seven Muskrat skins from Hayfield, Iowa, all of which were uniformly marked, having a white ring around the neck and the entire under parts, feet and terminal portion of tail white. Such uniform coloration in a series of specimens was perplexing and suggestive, especially as they all came from the same locality; but later two specimens were received from Indiana, which were similarly marked, but with the dark parts much paler. The Field Museum collection contains a pure white example of this species.

The Muskrat or "Musquash," as it is sometimes called, is common in the ponds, streams and overflowed marshes throughout Illinois and

Muskrat (*Fiber zibethicus*).

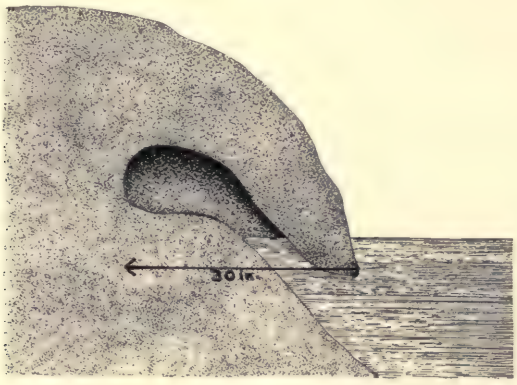
Wisconsin. It is a semi-aquatic animal, spending the greater part of its time in the water. Although largely nocturnal in its habits, it is often to be seen in the daytime either swimming about or sunning itself on a log or along the shore. Like the Beaver it constructs a house for itself for winter use, although it not uncommonly uses a hole which it digs in a bank, often doing considerable damage to dams and canal banks in localities where they are numerous. Brayton says, "Along the line of the Illinois and Michigan Canal, the 'canal walkers' are compelled to keep a sharp eye to the Muskrats, lest they burrow through the bank, and trappers, with their boats, are passed through the locks and given the right of way along the tow-path." (*l. c.*, p. 153.)

Of the many muskrat houses which I have examined a description of one will suffice. It was built in a marsh on the edge of a shallow pond; and it was constructed of reeds, weed stalks and sticks mixed with mud and was somewhat oblong in shape, although from a distance it appeared to be nearly round. The top of the rounded dome was three feet high measured from the surface of the swamp and slightly over four feet where built up from the side under water. The great-

A Muskrat House.

est diameter was 6 feet. The inside chamber measured about 20 x 17 inches, the height above the water being about 14 inches at the highest point, the ceiling being irregular. The floor of the chamber was about 7 inches above the water but slanted downward at one side to a large hole or passageway leading out under water into the pond. The size of the houses varies considerably, however, and many are larger.

When a hole in a bank is made, it is usually a simple affair, a single entrance under water and a passageway two or three feet long with an enlarged chamber at the end. In some cases the holes are considerably deeper, with two or more entrances and several connecting passageways, but in such cases I believe they were used by several animals. In winter when the ponds and streams are frozen over, these animals find



Muskrat burrow in a bank.

more or less air in spaces under the ice, but there is generally a regular air hole in the ice, which is kept open by frequent use.

The food of the Muskrats consists mainly of vegetable matter, aquatic plants and roots, but they are fond of fresh-water mussels and, when a cultivated field or apple orchard is near by the pond in which they live, they are not averse to an addition to their bill of fare in the way of vegetables and fruit. They also occasionally eat fish and dead birds when they can get them. In this connection, Dr. C. H. Merriam quotes Mr. W. H. Dall as follows:—

" 'In 1863, I visited Kankakee, Illinois, on a collecting tour for river mollusks, in July. You know how the Muskrats throw up mounds of the shells they dig out. I examined many of these for *Unios*, etc. On several I saw the skeletons of fish (chiefly suckers I believe) partly or wholly denuded of their flesh, and showing the marks of Muskrat (or at least rodent) teeth. I also saw the shell of a common mud turtle,

so gnawed and in the same situation. I did not see the animal in the act of feasting, which I believe is chiefly done at night, but I have no doubt that the fish and turtle were eaten by the Muskrat, as well as the mollusks associated with them in the same pile.'" (*l. c.*, p. 286.) Dr. Merriam also says: "Mr. Charles F. Carr writes me that in Wolf River, Wisconsin, twelve or fifteen years ago, Muskrats were in the habit of eating fish from a gill net set there by a man named Rich." (*l. c.*, p. 287.)

Robert Kennicott gives an interesting account of the habits of this animal. He says: "The muskrat is active in winter, seeking its food under the ice, and carrying it into its burrow or house to be eaten. Though roots are sometimes found in a nest in winter, they are only such as have been recently brought in, no considerable stores of food being collected. The food, in winter, appears to consist of roots of aquatic plants. In summer, it also feeds upon the leaves of various plants, as well as upon mussels, (*Unios anodonta* and *U. plicatus*, etc.), of which they consume great quantities in some of our rivers. Collecting them at the bottom, it carries them in its teeth to a log, or stone, where, sitting upon its haunches and grasping them in the fore-paws, it opens the shell with the incisors as skillfully as it could be done with an oyster-knife. In this way, large piles of shells are collected around stones and logs, by examining which the conchologist may often find rare species, brought from the mud by these animals which have been more successful collectors than himself. I have observed that those species with thin shells are most sought for, and have often found large specimens of *Unio plicatus* unopened among the piles of empty shells, the muskrat apparently considering them not worth the trouble of gnawing apart the valves at the back, in which manner the heavy shells are sometimes opened.

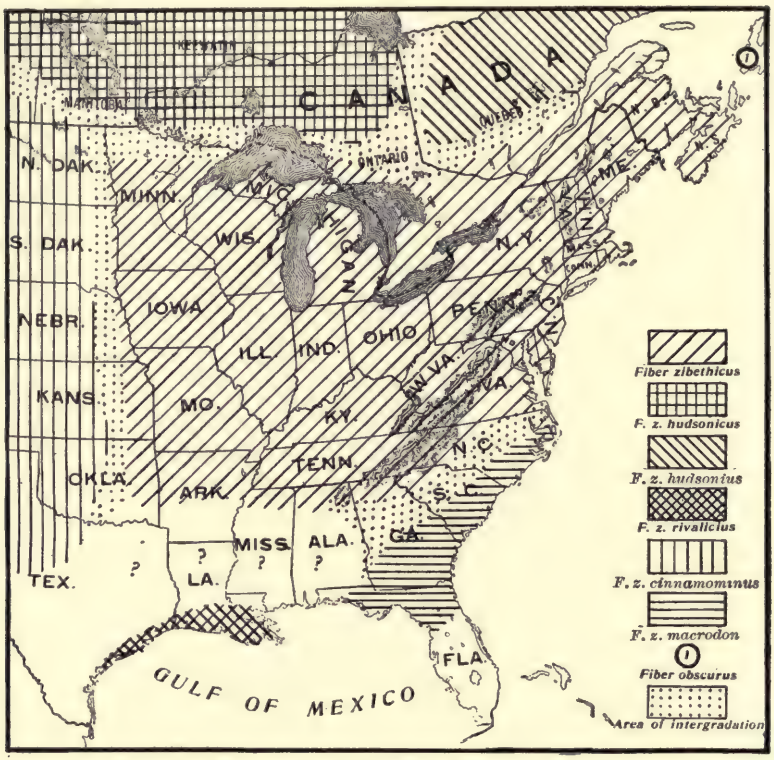
"This species is pugnacious, and resists courageously when attacked. The males sometimes have fierce battles, and trappers state that the tail is occasionally mutilated, or cut entirely off in these combats. The voice is a sharp squeak, and some hunters will call the males within shooting distance by imitating it. From five to seven young — more or less — are produced in April or May. In this region, at least, the muskrats' worst enemy is the mink, which, swimming and diving readily, not only enters their burrows and houses, but pursues them in the water. The mink does not find an easy prey, as the muskrats fight savagely; but, emboldened by hunger, he finally kills his victim, when he does not scruple to devour the whole body. Otters probably kill them, also, as they are occasionally found in muskrat houses." (*l. c.*, pp. 106–107.)

The flesh of the Muskrat is palatable and is more generally eaten than most people suppose; in this connection the following statement by Lantz is of interest: "In February, 1907, the Philadelphia Record stated that a single dealer in Dock street in that city sold about 3,000 muskrats a week for food. The chief source of this supply was stated to be in the vicinity of Salem, N. J. The Saginaw (Mich.) Courier-Herald states that in the season of 1907–8 dressed muskrats in that place retailed at from 15 to 20 cents each, and that dealers had ready sale for all they could provide. Muskrat is said to be a favorite dish at dinners given by church societies in Delaware and Maryland, and annual muskrat banquets are a feature with certain gun clubs in the West. Those of the Munroe (Mich.) Marsh Club have been celebrated for many years." * Kennicott informs us that in early days the *Pottawattamie* Indians ate the flesh of the muskrat boiled with corn or roasted, and that hunters and trappers "esteem the tail a great delicacy."

Immense numbers of these animals are annually trapped for their skins which are in popular demand among the cheaper class of furs. According to Lantz the records of the London importation and sales are as follows: "From 1763 to 1800 (thirty-eight years) the total number of skins imported and sold in that market was 2,831,453, an average of less than 75,000 yearly. During the fifty years from 1801 to 1850 the total was 20,571,428, or an average of 411,000 yearly. From 1851 to 1890, inclusive, the importations were 99,893,591, a yearly average of 2,500,000. The average London sales in recent years have been over 4,000,000 per annum, and the entire output of skins for 1900 was 5,285,000. A large part of the total collection is sold through London, but in the last few years an increasing number are dressed and manufactured in America." (*l. c.*, p. 24)

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Libertyville, 1; Chicago, 4; Warsaw, 1 = 6.
Wisconsin — Sayner, 1; Milton, 1; Green Bay, 2; Conover, 1; Eagle River, 1; Beaver Dam, 3; (M. P. M.) Milwaukee, 1; Muskego Lake, Waukesha Co., 1; Pewaukee, 5; Delavan, 2; Maiden Rock, 1; (O. C.) Mercer, 15 (skulls); Turtle Lake, Barron Co., 1; Lake Pewaukee, 4; Cedar Lake, Turtle River, Iron Co., 1; Colfax, Dunn Co., 12 (skulls) = 52.
Minnesota — Aitken, 3.
Iowa — Mayfield, 7.
Indiana — La Porte, 2.

*U. S. Dept. Agr., Farmers' Bull. 396, 1910, p. 22.



Map illustrating approximate distribution of Muskrats (*Fiber*) in eastern United States and Canada.

Fiber zibethicus (LINN.). Type locality — Eastern Canada. Description as previously given.

Fiber z. hudsonius PREBLE. (N. Amer. Fauna, No. 22, 1902, p. 53.) Type locality — Fort Churchill, Keewatin, Canada. Smaller and paler than *zibethicus*, with smaller molars.

Fiber z. cinnamominus HOLLISTER. (Proc. Biol. Soc. Wash., XXIII, 1910, p. 126.) Type locality — Wakeeney, Trego Co., Kansas. Coloration pale; smaller and more reddish than *zibethicus*.

Fiber z. aquilonius BANGS. (Proc. N. Eng. Zōol. Club, I, 1899, p. 11.) Type locality — Rigoulette, Hamilton Inlet, Labrador. Darker and upper parts more blackish than *zibethicus;* hind foot smaller.

Fiber z. macrodon (MERRIAM). (Proc. Biol. Soc. Wash., XI, 1897, p. 143.) Type locality — Lake Drummond, Dismal Swamp, Norfolk Co., Virginia. Color darker and richer than *zibethicus;* teeth larger.

Fiber z. rivalicius BANGS. (Proc. Bost. Soc. Nat. Hist., XXVI, 1895, p. 541.) Type locality — Burbridge, Plaquemines Parish, Louisiana. Smaller than *zibethicus* and coloration more dull and sooty.

Fiber obscurus BANGS. (Proc. Biol. Soc. Wash., IX, 1894, p. 133.) Type locality — Codroy, New Foundland. Smaller than *zibethicus;* upper parts darker, and under parts and sides less ferruginous.

Genus **SYNAPTOMYS** Baird.

Synaptomys Baird, Mammals N. Amer., 1857, p. 558. Type *Synaptomys cooperi* Baird.

Front of upper incisors (front teeth) with distinct groove near outer edge; molars without pronged roots; tail short; face of incisors orange brown in color; crowns of molars with transverse loops. A North American genus comprising two subgenera, *Synaptomys* and *Mictomys*, but only the former is represented within our limits. The subgenus *Synaptomys* has the crowns of the lower cheek teeth (molars) with closed enamel triangles, a loop on the *outer edge*, and the mammæ are 6.

Front view of incisors (enlarged).

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{0-0}{0-0}$, M. $\frac{3-3}{3-3}$ = 16.

Subgenus **SYNAPTOMYS** Baird.

Synaptomys cooperi gossii (MERRIAM).

GOSS'S LEMMING MOUSE.

Synaptomys helaletes gossii MERRIAM, Proc. Biol. Soc. Wash., X, 1896, p. 60.

Synaptomys gossi HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 30 (Missouri and southern Illinois).

Synaptomys cooperi COUES, Monog. N. Amer. Rodentia, 1877, p. 235–236 (part) (southern Illinois). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 43 (Iowa). WOOD, Ill. State Lab. Nat. Hist., VIII, 1910, p. 559 (Champaign Co., Ill.).

Type locality — Neosho Falls, Woodson Co., Kansas.

Distribution — Kansas, Missouri and southern Illinois, northward through at least a considerable portion of Illinois, Iowa and Nebraska to South Dakota; range not satisfactorily determined.

Description — Adult in summer: General color of upper parts dark rusty brown or reddish brown mixed with black tipped hairs; under parts plumbeous gray, the hairs with white tips but the plumbeous under fur showing through; a dusky mark at base of the whiskers; tail brownish above, paler beneath; skull larger and heavier and brain case actually and relatively longer than in *cooperi*.

Adult in winter: Grayer and decidedly less reddish brown. Immature specimens are quite different, the general color of the upper parts being dusky slate or grayish brown according to age.

Measurements — Total length, about 5 in. (128 mm.); tail vertebræ, .70 in. (17.5 mm.); hind foot, .75 in. (19 mm.).

The field measurements of six specimens in this Museum, collected by E. Heller at Rosiclare, Hardin Co., Illinois, are as follows:

	Total Length.	Tail Vertebræ.	Hind Foot.
No. 16049, ♂	132 mm.	19 mm.	19.5 mm.
No. 15782, ♂	122 "	17 "	19 "
No. 15784, ♂	128 "	18 "	19 "
No. 16051, ♂	130 "	20 "	19.5 "
No. 16052, ♀	130 "	18 "	20 "
No. 15781, ♀	128 "	17 "	19.5 "

The measurements of the smallest and largest of six specimens, which I have examined, from Horseshoe Lake, Missouri, collected by A. H. Howell, in the U. S. Biological Survey collection, are as follows: Total length, 118 and 136 mm.; tail vertebræ, 18 and 21 mm.; hind foot, 18 and 20 mm.

The distribution of the various forms of *Synaptomys* is not definitely known. Specimens which I have examined from Indiana, which have been recorded by various authors as *cooperi* (or *stonei*, a supposed form which is probably not separable from it), are apparently intermediate between *gossii* and *cooperi*, although perhaps averaging nearer the latter, and the same may be said of specimens from east central Illinois (Champaign Co.), while those I have seen from Ann Arbor, Michigan, seem to be intermediate between *cooperi* and *fatuus*. Specimens from southern Illinois agree very well with typical *gossii*, as do those from Iowa; and Hahn states* he secured examples from the Missouri River, South Dakota, which he considered to be *gossii*, as they differed "markedly from the Indiana specimens in being much larger and clumsier, with larger and heavier skull." So far as I know, no specimens of *Synaptomys* have been taken in northern Illinois or southern Wisconsin, but those from northern Wisconsin are apparently *fatuus*, as they agree in size and cranial characters (including the small narrow incisors) with examples of that form in this Museum from the type locality, Lake Edward, Quebec. Minnesota specimens which I have seen, while not typical, are near *fatuus*.

While the eastern form of this Mouse, *Synaptomys cooperi*, is an inhabitant of swamps and sphagnum bogs, in the western part of its range it does not appear to restrict itself to such localities; in fact, in Indiana, where it appears to intergrade with *gossii*, by far the greater number have been taken in grassy fields and open woods. Hahn states (*l. c.*, p. 523) that he secured but a single specimen in a swamp, and that they seemed to be confined to areas covered with dense blue grass. In describing the habits of *Synaptomys* in Indiana, Quick and Butler say:

* Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 522.

Goss's Lemming Mouse (*Synaptomys cooperi gossii*).

"This mouse is found on hillsides in high, dry, blue grass pastures, where flat stones are irregularly scattered over the surface; it especially prefers what are known as 'wood pastures' containing little or no undergrowth. . . . Cooper's field mouse has been found breeding from February to December. It has never been known by the authors to bring forth more than four young at a time. . . . The nest of this species is always under cover, generally in a hollow log or stump, and is composed of fine grass. It is not so securely built as the nests of some of the other species of this family.

"Cooper's mice live in winter chiefly upon the stems of blue grass and the more tender portions of the white clover. Stores of these foods may be found near their winter quarters. In November, 1883, a large quantity of the tuberous roots of the plant commonly called 'wild artichoke' (*Helianthus doronicoides* Lam.) were found in one of the store-houses of a colony of these mice. . . . Cooper's mouse is the most active representative of its family in this locality. It is most frequently found by turning over stones and logs, beneath which it remains concealed, especially in winter. Upon removing their covering, as the light reaches them, they are off like a flash for their subterranean paths, leaving the collector to mourn for a valuable specimen, a glimpse of which he caught as it fled before his hand could grasp the prize." (Amer. Nat., XIX, 1885, pp. 114, 115.)

So few specimens have been taken in Illinois that we know very little as to its habits in the state. Thus far it has been taken only in Hardin, Champaign, and Marion counties. The specimens recorded by Wood as found dead near Urbana, Champaign Co., were "on a low bluff overlooking a creek, in pasture land where there were stumps and scattered trees." (*l. c.*, p. 56.) In southern Illinois, however, they seem to prefer swampy localities, as do those which have been taken in Missouri.

Mr. A. H. Howell found this species common at Horseshoe Lake, St. Charles County, Missouri. He says, "A large colony had occupied a low marshy meadow close to the Mississippi River. At the time of my visit the water in the river was very high, and the meadow was overflowed to the depth of 12 to 18 inches. The mice had been driven from their burrows by the high water, and were hiding as well as they could on tussocks and under patches of floating debris. When disturbed they ran rather slowly over the submerged vegetation and swam freely, but were easily overtaken. Many had been killed by dogs or other predatory animals, and I was able to get as many specimens as I needed by catching them in my hands. The burrows in this meadow were on little hillocks, the entrances near the top. Thus they are probably dry except in times of very high water. The entrances are perfectly open and not concealed under vegetation as is the habit of *Synaptomys cooperi* in the eastern States. Well beaten runways extended out from the burrows and under the dead vegetation." (*l.c.*, p. 30.)

Mr. Howell secured a single specimen of *Synaptomys* in Illinois, which he provisionally referred to this form. It was taken in an old dry marsh at Odin, Marion Co. He states that it agrees with *gossii* in color, but the skull is too young to be properly identified (*l. c.*, p. 30).

Specimens examined from Illinois and adjoining states:

Illinois — Rosiclare, Hardin Co., 11; (I. S. L.) (intermediate between *gossii* and *cooperi*) Urbana, Champaign Co., 2 (only one with skull).

Missouri — (B. S.) Horseshoe Lake, 6.

Iowa — (N. M.) Knoxville, 1.

Indiana — (Not typical, intermediate between *gossii* and *cooperi* but averaging nearer *cooperi*) Bascom, 2; Mitchell, 2; Hebron, 1; Brookville, 1 = 6.

Synaptomys cooperi fatuus (BANGS).

BANGS'S LEMMING MOUSE.

Synaptomys fatuus BANGS, Proc. Biol. Soc. Wash., X, 1896, p. 47. MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, No. 1, 1897, p. 11 (North Bay and Peninsular Harbor, Ontario).

Type locality — Lake Edward, Province of Quebec, Canada.

Distribution — Eastern Canada, south to Maine, New Hampshire and northern Wisconsin and probably northern Michigan and Minnesota; exact limits of range unknown.

Description — Similar to *S. cooperi*, but averaging somewhat smaller and darker, the skull smaller and the upper incisors shorter and narrower.

Measurements — Total length, about 4.75 in. (120.5 mm.); tail vertebræ, .69 in. (17.5 mm.); hind foot, .71 in. (18 mm.).

The following are the field measurements of six specimens collected by Mr. W. H. Osgood in northern Wisconsin:

	Total Length.	Tail Vertebræ.	Hind Foot.
No. 18302, ♂, Conover, Vilas Co.....	128 mm.	18 mm.	18.5 mm.
No. 18304, ♀, Conover, Vilas Co.....	122 "	18 "	18.5 "
No. 18303, ♀, Conover, Vilas Co.....	121 "	17 "	18 "
No. 18305, ♀, Lac Vieux Desert, Vilas Co.	117 "	17 "	19 "
No. 16250, ♀, Sayner, Vilas Co.....	103 "	17 "	19 "
No. 16249, ♂, Solon Springs, Douglas Co.	116 "	17 "	17.5 "

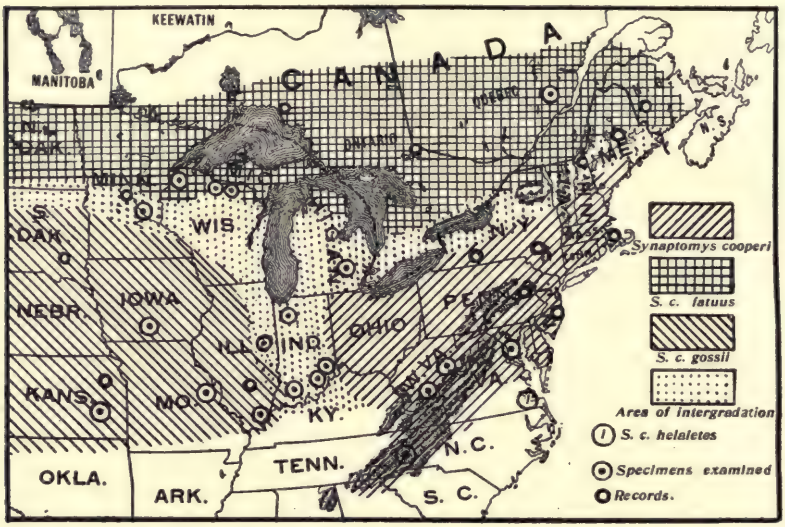
So far as I am aware, Bangs's Lemming Mouse has not been previously recorded from Wisconsin. Specimens in this Museum from northern Wisconsin approach much nearer to this form than to *cooperi* and agree very well in size and cranial characters with those from the type locality. Bangs's Lemming Mouse is, no doubt, not uncommon in suitable localities throughout at least the northern portion of the state. Its natural habitat is wet bogs and sphagnum swamps both in open places and in woods. Mr. Osgood informs me that in the localities he visited in Vilas County they were quite scarce and were only found in small numbers in isolated colonies in cold sphagnum swamps. Even where occasional specimens were caught, continued trapping often failed to secure others. Mr. Gerrit S. Miller secured specimens of this Mouse at Peninsular Harbor, Ontario, in the northern shore of Lake Superior, where, he says, it frequently occurs at the borders of clearings especially near boggy places grown up to bushes. He caught one under the foundation of a disused log cabin in low ground near the woods and secured others in pitfalls dug at the edge of a garden. He says, "wherever the animal occurred it lived in cavities among roots covered with moss and sphagnum. Even in places where it was most abundant I could find no beaten runways." (*l. c.*, p. 12).

Specimens examined from Wisconsin and adjoining states:

Wisconsin — Solon Springs, Douglas Co., 1; Sayner, Vilas Co., 1; Lac Vieux Desert, Vilas Co., 1; Conover, Vilas Co., 3 = 6.

Minnesota — (N. M.) Elk River, 1; not typical but approaching *fatuus*.

Michigan — (B. S.) Ann Arbor, 2; intermediate between *fatuus* and *cooperi*.



Map illustrating the supposed distribution of Lemming Mice belonging to the subgenus *Synaptomys*, which occur in eastern United States. The map is provisional, as the ranges of the various forms have not been determined. No attempt has been made to include all records east of Indiana and Michigan.

Synaptomys cooperi BAIRD. (Mammals N. Amer., 1857, p. 558.) Type locality — Unknown; supposed to be New Jersey. Color, sepia to tawny brown (more or less variable) mixed with scattered black hairs on back; hairs on under parts plumbeous, with whitish tips; mammæ 6. Total length, about 4.75 in. (120 mm.); tail vertebræ, .70 in. (17.5 mm.); hind foot, .72 in. (18 mm.).

Synaptomys c. fatuus BANGS. Type locality — Lake Edward, Quebec, Canada. Similar to *cooperi*, but averaging smaller and somewhat darker than *cooperi;* skull smaller and upper incisors shorter and narrower. Occurs in northern Wisconsin and northward.

Synaptomys c. gossii (MERRIAM). Type locality — Neosho Falls, Woodson Co., Kansas. Size averaging larger than *cooperi* and color more reddish brown; skull larger and rostrum narrower; smaller audital bullæ. The brain case in adult specimens is both actually and relatively longer than *cooperi*.

Synaptomys c. helaletes (MERRIAM). (Proc. Biol. Soc. Wash., X, 1896, p. 59.) Type locality — Dismal Swamp, Norfolk Co., Virginia. Similar to *cooperi*, but skull somewhat longer and heavier; tail shorter and feet larger. "Similar to *S. cooperi*, but with larger head and feet, longer tail, much broader rostrum and mandible, and larger and more massive skull and teeth" (Merriam).

Family GEOMYIDÆ. Pocket Gophers.

The *Geomyidæ* are a family of fossorial or burrowing Rodents commonly known as Pocket Gophers, which are restricted, so far as known, to North and Central America. They are characterized by the greatly developed claws of the fore feet, small eyes and ears and external cheek pouches lined with fur, which open on the sides of the face. Nine genera, three of which occur in the United States, and more than 100 species and subspecies are recognized, but only one genus and a single species occur within our limits.

Genus **GEOMYS** Rafinesque.

Geomys Rafinesque, Amer. Monthly Mag., II, 1817, p. 45. Type *Geomys pinetis* Rafinesque.

Front view showing cheek pouches and grooved upper incisors.

Upper incisors with two grooves (bisulcate), a deep one in the middle and much smaller and narrower one near the inner edge; first and second upper molars with posterior enamel plate; infraorbital foramen confined to lower portion of maxilla; auditory meatus much elongated and tubular, opening between the mastoid process of the squamosal and posterior root of zygoma*; crowns of cheek teeth with transverse enamel loops, a single loop on each molar and two on the premolar; claws of fore feet much elongated; external cheek pouches large, opening on sides of face; eyes small; tail thick, much shorter than the body, and the terminal portion scantily haired; ears very small.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{1-1}{1-1}$, M. $\frac{3-3}{3-3} = 20$.

Geomys bursarius (SHAW).

POCKET GOPHER.

Mus bursarius SHAW, Trans. Linn. Soc. Lond., V, 1800, p. 227.

Geomys ? bursarius RICHARDSON, Fauna Bor. Amer., I, 1829, p. 203.

Geomys bursarius LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 580 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858,

*See Illustration, p. 96.

p. 72 (Illinois). BAIRD, Mammals N. Amer., 1857, p. 377 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 190 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, II, 1883, p. 440 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 223 (Minnesota). MERRIAM, N. Amer. Fauna, No. 8, 1895, p. 120 (Minnesota, Iowa, Missouri, Illinois, Wisconsin, etc.). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 24 (Wisconsin). *Ib.*, VIII, 1910, p. 88 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 524 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 31 (Illinois). VAN HYNING & PELLETT, Proc. Iowa Acad. Sci., XVII, 1910, p. 212 (Iowa).

Type locality — Uncertain, supposed to be upper Mississippi Valley.

Distribution — From North Dakota and northern Wisconsin south to eastern Kansas and Illinois; occurs sparingly in western Indiana. In Illinois it has been recorded by Howell as far south as Randolph and Jefferson counties; replaced in more southern and western states by other forms.

Description — Somewhat larger than a House Rat and much more thick set; neck very short; cheeks provided with pockets which open on the outside and are lined with fur; tail stout, the terminal portion nearly bare; eyes and ears small. General color dull chestnut brown, the under parts paler; concealed bases of the hairs dark plumbeous; feet whitish; hair on basal portion of tail like the back, the few scanty hairs on terminal portion white or whitish; front feet greatly developed for digging, the claws noticeably large and long.

Average measurements — Total length, about 11 in. (279 mm); tail vertebræ, 3.25 in. (82.6 mm.); hind foot, 1.45 in. (37 mm.).

The Pocket Gopher occurs throughout the greater portion of Illinois and Wisconsin in localities where there are prairie lands and open places where the soil is loose and sandy. Kennicott states that in 1853, while it was not common in Cook County, Illinois, it was "very abundant on the prairies in the middle of the state where the farmers are greatly injured by it." Wood reports it from Mason Co. and states it is reported to be common in the western part of the state (*l. c.*, p. 561). There is a specimen in this Museum from Anderson, Macoupin Co.; Dr. Merriam records it from Cook and St. Clair counties (*l. c.*, 1895, p. 120); and Baird mentions specimens from Morgan and Tazewell counties, Illinois (*l. c.*, p. 377). Howell found it in Randolph, Jefferson, Marion, and Richland counties and he considers Coulterville in Randolph County to be about the southern limit of its range in Illinois (*l. c.*, p. 31).

In Wisconsin it is locally distributed throughout the greater portion of the state. I have seen specimens from Douglas, Dunn, Burnett

Pocket Gopher (*Geomys bursarius*).

and Buffalo counties; Jackson reports them from Pepin, Pierce and Dunn counties (*l. c.*, 1908, p. 24), and in a later paper he states that they are "exceedingly abundant in parts of the sandy country in the southern two-thirds of Bayfield and Douglas counties" (*l. c.*, 1910, p. 88). In the southeastern part of the state they are rarely found, although Dr. Merriam records specimens from Winnebago and Fond du Lac counties (*l. c.*, p. 120).

The Pocket Gophers live in underground tunnels which they excavate in loose alluvial soils. Their food consists mainly of roots of various plants, but they also attack the roots of trees and often do considerable damage to orchards. Lantz says,* "Originally they subsisted on roots and stems of native plants, but they immediately turned their attention to the cultivated plants introduced by the settler, including succulent garden vegetables, alfalfa, and clover; they are indebted to the settler also, for the destruction of many of their natural enemies and for loosening the soil by tillage. Thus the gopher's environment is greatly improved, and except where due vigilance has been exercised, these pests have multiplied, and greatly extended their range in cultivated lands." In writing of its depredations the same author says: "In attacking nursery trees the gopher takes the entire root, not merely the bark. It does not eat the roots all at once but cuts them into short pieces, packs them into its enormous cheek pouches, and carries them away to its caches, or stores of food. It is these provisions for the future that make its injury to young orchards, nurseries, and gardens so extensive. The animal lays up far more than it ever consumes. It is not uncommon to plow up stores of small potatoes or roots of clover, alfalfa, or trees amounting to from a peck to half a bushel at a place. As the stores are usually placed much deeper in the ground, those uncovered by the ploughman are but a small portion of those deposited by the animals" (*l. c.*, p. 213).

In writing of this species Kennicott says, "East of the Mississippi it has been found in some parts of Indiana,† Michigan, and Wisconsin; and on the great prairies in Central Illinois; also south and east of the Illinois River it is constantly met with. . . . On the wild prairie, the gopher throws up a mound of earth of considerable size, frequently 10 feet in diameter and from 1½ to 2 feet in height, being highest on the low ground liable to inundation. In this mound is his nest, in which the young are bred; and from it, endless galleries are excavated in various directions, a foot or two below the surface. These are complicated, frequently intersecting and running together, and in short,

* Pocket Gophers as Enemies of Trees. Yearbook Dept. Agr., 1909, pp. 210–211.

† Its range in Indiana appears to be restricted to the western portion of the state. Hahn records it from Newton and Lake counties (*l. c.*, p. 525).

forming a complete network of underground roads through which these strange animals can travel for miles. In digging them, the gophers run up shafts at irregular intervals from 2 to 10 feet apart, which open to the surface usually a little at one side of the main gallery, and from each of these side cuts they throw out the earth brought from the main gallery below, to the amount of from a quart to one or more bushels, and thus form little piles of earth by which the general course of the burrow may be traced. They have a remarkable antipathy to the light and these side cuts are usually closed again with earth after they have served their first purpose. . . . The main galleries are about 4 inches in diameter and the side cuts from 2 to 3 inches. . . . As observed in captivity, when the gopher begins to dig from the surface, he at first loosens the earth with his claws, aided sometimes with his teeth, then scratches it back with his fore-feet, and throws it further off with his hind-feet. As the hole deepens, he does not always carry out the earth in his pouches, but frequently, after throwing it behind him a short distance, turns round and simply pushes it forth with his head and shoulders, sometimes filling his pouches first and pushing before him a quantity of earth besides. In carrying it for some distance within his burrow, however, he appears oftener to convey it all in his pouches. . . .

"The proper food of the gopher consists of roots, which are usually obtained without leaving his underground roads. Though he sometimes comes to the surface to feed upon the leaves and seeds of plants, this does not appear to be his principal means of subsistance. The manner in which he naturally procures food is by approaching it from below, without coming above ground at all. He lays up stores, apparently, at all seasons. Considerable quantities of the roots of the rosin-weed (*Silphium laciniatum*), wild artichokes or wild sunflower (*Helianthus*?), spike flower (*Liatris*?), and various other plants, are collected in its burrows on the prairies; while, in cultivated fields, I am informed, the roots of the grasses, potatoes, and other vegetables are found in its holes" (*l. c.*, pp. 72–75).

The young number from 3 to 6, generally 4 or 5, and the majority are born in April in this latitude.

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Anderson, 1.
Indiana — St. Joseph, 1.
Minnesota — Ft. Snelling, 4.
Wisconsin — (M. P. M.) Fountain City, 4; Prescott, Pierce Co., 6; St. Croix Dam, 1; Mouth of Yellow River, Burnett Co., 2; Rush City Bridge, Burnett Co., 1; (S. C.). Meridian, Dunn Co., 2 = 16.

Map illustrating approximate range of the Pocket Gopher (*Geomys bursarius*), together with the type localities of other species and subspecies of the genus which occur in the United States.

Geomys bursarius (SHAW). Type locality — Upper Mississippi Valley. Description as previously given.

Geomys lutescens (MERRIAM). (N. Amer. Fauna, No. 4, 1890, p. 51.) Type locality — Sandhills, Birdwood Creek, Lincoln Co., western Nebraska. Paler than *bursarius* and skull shorter.

Geomys breviceps BAIRD. (Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 335). Type locality — Prairie Mer Rouge, Morehouse Parish, Louisiana. Smaller than *bursarius*, and much darker above and below.

Geomys b. sagittalis MERRIAM. (N. Amer. Fauna, No. 8, 1895, p. 134.) Type locality — Clear Creek, Galveston Bay, Texas. Similar to *brevipes*, but smaller and more highly colored.

Geomys b. attwateri MERRIAM. (N. Amer. Fauna, No. 8, 1895, p. 135.) Type locality — Rockport, Aransas Co., Texas. Similar to *brevipes*, but larger and not so dark.

Geomys b. llanensis BAILEY. (N. Amer. Fauna, No. 25, 1905, p. 129.) Type locality — Llano, Llano Co., Texas. Larger and lighter than *brevipes;* skull more arched.

Geomys texensis MERRIAM. (N. Amer. Fauna, No. 8, 1895, p. 137.) Type locality — Mason, Mason Co., Texas. A small white-bellied species with nasals shorter and broader than *brevipes*.

Geomys arenarius MERRIAM. (N. Amer. Fauna, No. 8, 1895, p. 139.) Type locality — El Paso, El Paso Co., Texas. Upper parts pale drab; somewhat resembling *lutescens*, but smaller and tail longer and more hairy.

Geomys personatus TRUE. (Proc. U. S. Nat. Mus., XI, 1888 (1889), p. 159.) Type locality — Padre Island, Cameron Co., Texas. Large and pale; several cranial differences, noticeably the zygomatic arches.

Geomys p. fallax MERRIAM. (N. Amer. Fauna, No. 8, 1895, p. 144.) Type locality — South side of Nueces Bay, Cameron Co., Texas. Much smaller than *personatus*, color darker, tail shorter.

Geomys tuza (ORD). (Guthrie's Geography, 2nd Amer. ed., II, 1815, p. 292.) Type locality — Pine barrens near Augusta, Richmond Co., Georgia. Color of upper parts cinnamon brown; tail longer and more naked and upper premolar relatively much longer than in western forms.

Geomys t. mobilensis MERRIAM. (N. Amer. Fauna, No. 8, 1895, p. 119.) Type locality — Mobile Bay, Baldwin Co., Alabama. Smaller and darker than *tuza;* audital bullæ much smaller than in *floridanus*.

Geomys floridanus (AUD. & BACH.). (Quadrupeds of N. Amer., III, 1854, p. 242.) Type locality — St. Augustine, St. John Co., Florida. Darker than *tuza*, and fore feet longer.

Geomys f. austrinus BANGS. (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 177.) Type locality — Belleair, Hillsboro Co., Florida. Similar to *floridanus*, but paler and more tawny; with more white on under parts.

Geomys colonus BANGS. (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 178.) Type locality — St. Mary's, Camden Co., Georgia. Darker than *floridanus*, together with slight cranial differences.

Geomys cumberlandius BANGS. (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 180.) Type locality — "Stafford Place," Cumberland Island, Camden Co., Georgia. Size large; color russet, with a darker dorsal stripe together with cranial differences.

Family ZAPODIDÆ. Jumping Mice.

The *Zapodidæ*,* or Jumping Mice, are a semi-boreal family comprising two well marked subfamilies — *Zapodinæ* and *Sminthinæ;* the latter, however, is not represented in North America. The subfamily *Zapodinæ* contains three genera, two of which are North American and which include about 20 species and subspecies, but so far only a single species, the Hudson Bay Jumping Mouse, *Zapus hudsonius*, has been taken within our limits. It is probable, however, that the Woodland Jumping Mouse, *Napæozapus insignis*, occurs in northern Wisconsin, as it has been taken in the Michigan peninsular. The two genera may be briefly characterized as follows:

Zapus.
(Much enlarged.)

Napæozapus.
(Much enlarged.)

A small upper premolar present; tail not tipped with white; teeth 18. Genus *Zapus*.

Upper premolar absent; tail tipped with white; teeth 16. Genus *Napæozapus*.

Subfamily ZAPODINÆ.

Genus **ZAPUS** Coues.

Zapus Coues, Bull. U. S. Geol. Surv. Terr., 2nd ser., I, 1875, p. 253.

Type *Dipus hudsonius* Zimmermann.

Tail very long and slender; hind legs greatly elongated; antorbital foramen large and oval; upper premolar present but small; crowns of molars with enamel much folded; upper incisors sulcate (grooved) and brownish orange in color; hind foot with 5 toes, each with separate metatarsal; fore foot with 4 functional toes with perfect claws and a rudimentary thumb with a flat nail; pelage rather coarse; internal cheek pouches present but small.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{1-1}{0-0}$, M. $\frac{3-3}{3-3}=18$.

* For reasons for recognizing the family *Zapodidæ* as distinct from *Dipodidæ*, see Lyon, Proc. U. S. Nat. Mus., XXIII, 1901, p. 659.

Zapus hudsonius (ZIMM.).

HUDSON BAY JUMPING MOUSE.

Dipus hudsonius ZIMMERMANN, Geog. Gesch. Mensch. u. vierfüss. Thiere, II, 1780, p. 358.

Jaculus americanus WAGLER, Nat. Syst. Amphib., 1830, p. 23.

Meriones Americanus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).

Jaculus hudsonius BAIRD, Mammals N. Amer., 1857, p. 430 (in part). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 192 (Iowa). STRONG, Geol. Wis. Surv., 1873–79, I, 1883, p. 438 (Wisconsin).

Jaculus labradorius KENNICOTT, Agr. Rept. for 1856, U. S. Patent Office Rept., 1857, p. 95 (Illinois).

Zapus hudsonius COUES & ALLEN, Monog. N. Amer. Rodentia, 1877, p. 476 (Cook Co., Illinois). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 218 (Minnesota). OSBORN, Proc. Iowa Acad. Sci., 1887–89 (1890), p. 43 (Iowa). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 125 (Indiana). PREBLE, N. Amer. Fauna, No. 15, 1899, p. 15 (Indiana, Wisconsin, Michigan, Minnesota, Ontario). MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 9 (North Bay and Nepigon, Ontario). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 116 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 24 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 140 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 528 (Indiana). EVERMANN & CLARK, Proc. Wash. Acad. Sci., XIII, 1911, p. 25 (Indiana).

Type locality — Hudson Bay.

Distribution — From Hudson Bay to New Jersey, and in the mountains to North Carolina, west through Ohio, Indiana, and greater portion of Illinois to Missouri and Minnesota. Intergrades with *americanus* in the southeastern portion of its range, and with *campestris* near the edge of the Great Plains.

Description — Body about the size of the Common House Mouse, but hind legs elongated and tail noticeably long and slender; top of head and back dark ochraceous brown; sides of body tawny or yellowish brown mixed with darker hairs; under parts and feet white or whitish, usually a clear yellowish brown line separating the color of the sides of the body from the white of the under parts; tail dark above, whitish beneath; a dusky mask near nose at base of the whiskers.

Measurements — Total length, 7.50 to 8.50 in. (190 to 215 mm.); tail vertebræ, 4.50 to 5.25 in. (115 to 133 mm.); hind foot, 1.15 to 1.24 in. (29.5 to 31 mm.).

Hudson Bay Jumping Mouse (*Zapus hudsonius*).

The Hudson Bay Jumping Mouse is found within our limits from northern Illinois northward throughout Wisconsin. I have examined specimens from Lake and Jo Daviess counties, Illinois, and from Vilas, Burnett, Marinette, Pierce, Dodge and Rock counties, Wisconsin. Hollister records it from Racine and Walworth counties (*l. c.*, p. 140), and Jackson from Oneida County, Wisconsin, and it undoubtedly occurs throughout the state.

This curious Mouse inhabits both fields and woodland and I have seen it in bogs, although on the whole it seems to like brush grown places along fences and bordering timber. It is well named, for, when frightened, it makes a series of surprisingly long jumps, a distance of ten feet at a single leap being by no means unusual, and to a person who sees one of these little animals for the first time, its activity is astonishing. Suddenly from almost under his feet it goes flying through the air, barely touching the ground before it is up again with the seeming resiliency of a rubber ball, and the next moment it has disappeared in the bushes.

It makes a nest in burrows in the ground, under logs, and in hollow trees and stumps. In summer it also constructs a rounded nest which is concealed behind rocks or under bushes and thick grass. These nests are usually about 4 or 5 inches in diameter, the entrance being a hole at one side. The young are from 3 to 6 in number. This species hibernates in winter in this latitude. Preble states that during the cold weather they are generally found singly, although sometimes in pairs, in nests in holes in the ground, which vary from a few inches to three feet below the surface. He says, "They lie rolled up like a ball with the feet close together and the tail curled about them. If removed from the nest and subjected to a moderate degree of heat, they revive and in the course of a few hours move about freely, but generally resume their lethargic state if again exposed to cold. The pulse and respiration are very slow" (*l.c.*, p. 9). He also states that these animals sometimes hibernate in a nest above ground.

Kennicott says, "Dr Hoy informs me that when he was a boy, in digging out a rabbit in winter, he found a pair of this species in a state of profound torpor, exhibiting all the phenomena of perfect hibernation. They were in a large nest of leaves situated two or three feet below the surface" (*l.c.*, p. 97).

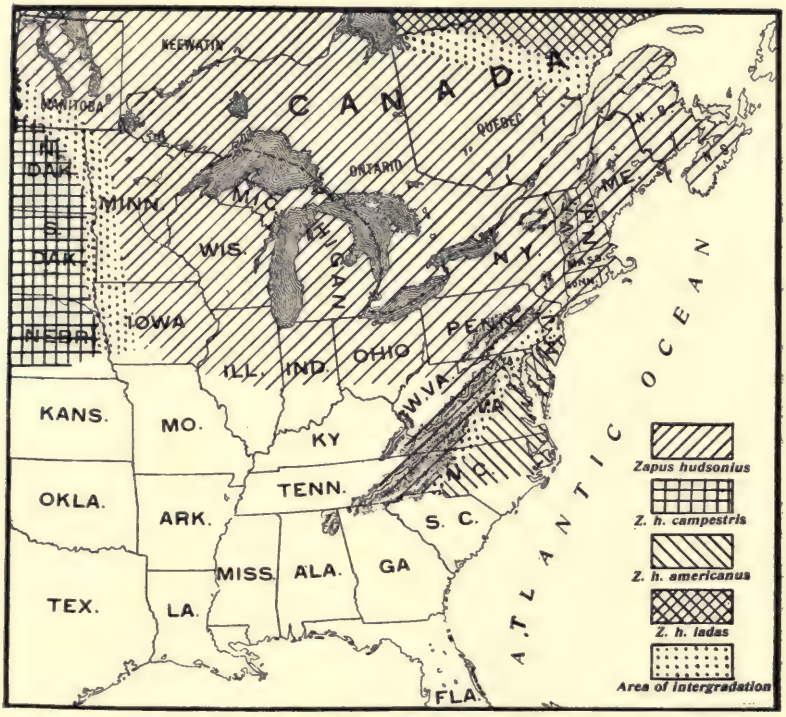
An interesting article on the hibernation of the Jumping Mouse in Indiana is given by Professor Sanborn Tenney.* He says, "On the 18th of January of the present year (1872), I went with Dr. A. Patton of Vincennes, Indiana, to visit a mound situated about a mile or a mile

* Amer. Nat., VI, 1872, p. 330.

and a half in an easterly direction from Vincennes. While digging in a mound in search of relics that might throw light upon its origin and history, we came to a nest about two feet below the surface of the ground, carefully made of bits of grass, and in this nest was a Jumping Mouse (*Jaculus Hudsonius* Baird) apparently dead. It was coiled up as tightly as it could be, the nose being placed upon the belly, and the long tail coiled around the ball-like form which the animal had assumed. I took the little mouse in my hand. It exhibited no motion or sign of life. Its eyes and mouth were shut tight, and its little fore feet or hands were shut and placed close together. Everything indicated that the mouse was perfectly dead, except the fact that it was not as rigid as perhaps a dead mouse would be in the winter. I tied the mouse and nest in my handkerchief and carried them to Vincennes. Arriving at Dr. Patton's office I untied my treasures, and took out the mouse and held it for some time in my hand; it still exhibited no sign of life; but at length I thought I saw a slight movement in one of the hind legs. Presently there was a very slight movement of the head, yet so feeble that one could hardly be sure it was real. Then there came to be some evidence of breathing, and a slight pressure of my fingers upon the tail near the body was followed by an immediate but feeble movement of one of the hind legs. At length there was unmistakable evidence that the animal was breathing, but the breathing was a labored action, and seemingly performed with great difficulty. As the mouse became warmer the signs of life became more and more marked; and in the course of the same afternoon on which I brought it into the warm room it became perfectly active, and was as ready to jump about as any other number of its species.

"I put this mouse into a little tin box with holes in the cover, and took him with me in my journeyings, taking care to put in the box a portion of an ear of corn and pieces of paper. It ate the corn by gnawing from the outside of the kernel, and it gnawed the paper into bits with which it made a nest. On the fourth day after its capture I gave it water which it seemed to relish. On the 23d of January I took it with me to Elgin, Illinois, nearly three hundred miles farther north than the region where I found the specimen. The weather was intensely cold. Taking the mouse from the box, I placed it on a newspaper on a table, and covered it with a large glass bell, lifting the edge of the glass so as to admit a supply of air. Under this glass was placed a good supply of waste cotton. Soon after it was fairly established in its new and more commodious quarters, it began to clean every part of its body in the most thorough manner, washing itself very much in the same manner as a cat washes. On coming to the tail it passed

that long member, for its whole length, through the mouth from side to side, beginning near the body and ending at the tip. At night as soon as the lights were put out the mouse began gnawing the paper, and during the night it gnawed all the newspapers it could reach, and made the fragments and the cotton into a large nest perhaps five or six inches in diameter, and established itself in the centre. Here it spent the succeeding day. The next night it was supplied with more



Map illustrating approximate distribution of the Jumping Mice belonging to the genus *Zapus* in eastern United States.

Zapus hudsonius (ZIMMERMANN). Type locality — Hudson Bay. Description as previously given.

Zapus h. campestris PREBLE. (N. Amer. Fauna, No. 15, 1899, p. 20.) Type locality — Bear Lodge Mountains, Wyoming. Similar to *hudsonius* but slightly larger, brighter in color and brain-case higher.

Zapus h. americanus (BARTON). (Trans. Amer. Philos. Soc., IV, 1799, p. 115.) Type locality — Near Philadelphia, Penn. Smaller than *hudsonius*, with color of dorsal area less distinctly marked.

Zapus h. ladas BANGS. (Proc. N. Eng. Zoöl. Club, I, 1899, p. 10.) Type locality — Rigoulette, Hamilton Inlet, Labrador. Larger and darker than *hudsonius*, with longer tail and hind foot.

paper, and it gnawed all it could reach, and thus spent a large part of the night in work. I could hear the work going on when I was awake. In the morning it appeared to be reposing on the top of its nest; but after watching it for some time, and seeing no motion, I lifted up the glass and took the mouse in my hand. It showed no signs of life. I now felt that perhaps my pet was indeed really dead; but remembering what I had previously seen, I resolved to try to restore it again to activity. By holding it in my hand and thus warming it, the mouse soon began to show signs of life, and although it was nearly the whole day in coming back to activity, at last it was as lively as ever, and afterward, on being set free in the room it moved about so swiftly by means of its long leaps, that it required two of us a long time to capture it uninjured."

Describing the habits of the Jumping Mouse in northern Illinois, Kennicott says: "It is not very prolific and is nowhere numerous. In northern Illinois it is found in the deepest woods, as well as in cultivated fields, and on the prairie at a distance from any timber. In the woods it is often found nesting in situations similar to those occupied by the *Mus leucopus*. It cannot climb but crawls up the inside of hollow trees to a considerable height from the ground, and is sometimes found nesting in them; but its nest is often discovered under the bark of rotten trees or stumps and, though not much noticed when inhabiting these situations, it appears frequently, if not generally, to live in burrows in the ground, as it nearly always does in the fields, and on the prairies of course. It digs readily. Its burrow in summer is not deep, and the nest is sometimes found in a tuft of grass above the surface, or under an inverted sod. In cultivated fields, it lives under fences and, like the mice and arvicolæ, takes up its abode in grain that has been cut and left standing out.

"The food of this species appears to consist chiefly of herbaceous plants, with their seeds, and the seeds and nuts of trees when it inhabits the woods. In cultivated fields, it devours grain, of which it has sometimes been observed to collect stores in its burrows" (*l. c.*, p. 96).

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Fox Lake, 3; Galena, Jo Daviess Co., 3 = 6.
Wisconsin — Beaver Dam, Dodge Co., 5; Conover, Vilas Co., 1; (S. C.) Beaver Dam, Dodge Co., 12 = 18.
Michigan — Dowagiac, Cass Co., 2.

Napæozapus insignis (MILLER). WOODLAND JUMPING MOUSE. As has been previously stated, the Woodland Jumping Mouse may be looked for in northern Wisconsin, for, although it has not as yet been found within our limits, it has been taken in northwestern Michigan.* The white tipped tail and absence of the small upper premolar will distinguish it from *Z. hudsonius*.

Family ERETHIZONTIDÆ. American Porcupines.

The American Porcupines are short legged, slow-moving animals, with a thick body covering of hair mixed with quills or spines. They differ from the Old World Porcupines in having perfect clavicles; the skull somewhat different shaped; tuberculate soles of feet; absence of a pollex, etc.; and the quills are also much smaller. They are largely arboreal in habits. The quills or spines are loosely attached and fall out easily, but the animal is not able to forcibly eject them, and the legend of the Porcupine "shooting" its quills is, of course, absurd.† Five species and subspecies belonging to a single genus (*Erethizon*) are recognized in North America. Other genera belonging to this family occur in Central and South America, and have long prehensile tails.

* Porcupine Mountains — Adams, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129.

† This fable is of ancient origin, being mentioned by Solinus, Paulus Venetus and others in their accounts of the Old World Porcupine and gravely endorsed by Topsell and other subsequent compilers. Edward Topsell says, "When they are hunted the beast stretcheth his skin, and casteth the off, one or two at a time, according to necessity upon the mouths of the Dogs, or Legs of the Hunters that follow her, with such violence that many times they stick into trees" (Historie of Foure Footed Beastes, 1607, p. 588).

We can readily understand how early explorers in America would credit the American Porcupine with equal ability and thus have planted the seeds from which has grown a similar superstition regarding our species. Josselyn did not hesitate in doing so, describing our species as "a very Angry Creature, and dangerous, shooting a whole shower of Quills with a rowfe at their enemies." (New England Rarities, 1672, p. 17.)

Subfamily ERETHIZONTINÆ.

Genus **ERETHIZON** F. Cuvier.

Erethizon F. Cuvier, Mém. Mus. Hist. Nat. Paris, IX, 1822, p. 436. Type *Hystrix dorsata* Linn.

Body covered with hair mixed with quills or spines on back and sides, the spines loosely attached to the skin; tail short, thickly spiny and non-prehensile; toes four in front and five behind, armed with strong curved claws; ears short; mammæ 4, all pectoral; cæcum long;* the gall bladder apparently absent; skull with facial portion short; a horizontal process of the maxillary extends outward, joining the zygoma forming a large antorbital vacuity and having the appearance of a second zygoma (see fig. 6, p. 96); auditory meatus with protruding edge; crowns of molars with enamel folds and more or less completely rooted; tibia and fibula separate and not anchylosed below.

Dental formula: I. $\frac{1-1}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{1-1}{1-1}$, M. $\frac{3-3}{3-3} = 20$.

Erethizon dorsatum (LINN.).

CANADA PORCUPINE.

[*Hystrix*] *dorsata* LINNÆUS, Syst. Nat., X ed., I, 1858, p. 57.

Hystrix Hudsonius LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). HAYMOND, Rept. Geol. Surv. Ind., 1869, p. 208 (Indiana).

Erethizon dorsatus KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 91 (Illinois, Indiana). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 221 (Michigan). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 246 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 125 (Indiana).

Hystrix dorsata STRONG, Geol. Wis., Surv. 1873–79, 1883, p. 440 (Wisconsin).

Erethizon dorsatum ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 129 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 24 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 530 (Indiana). EVERMANN & CLARK, Proc. Wash. Acad. Sci., XIII, 1911, p. 2 (Indiana).

Type locality — Eastern Canada.

Distribution — At present, northern North America south to Maine, the mountains of Pennsylvania, northern Michigan, Wisconsin and Minnesota. Formerly its range extended south to Indiana.

Description — Hair on upper parts mixed with quills or spines; general color dark brown to nearly black, often mixed with yellowish white hairs; hair of upper parts long, nearly or quite concealing the quills

* Beddard gives the length of the cæcum in *Erethizon* as 2 feet 4 inches (Mammalia, 1902, p. 499).

except on the lower back, hips, and sides of base of tail where they are longest; quills blackish at tip, whitish at base, the largest ones having a length of from 3 to 4 inches, they lie flat but can be erected by muscular contraction; incisors deep orange.

Measurements — Total length, about 35 in. (890 mm.); tail, 5.50 to 6.50 in. (152 mm.); hind foot, 3.50 in. (90 mm.).

At the present time the range of the Porcupine within our limits is restricted to northern Wisconsin, but in early days it probably extended considerably farther south. Porcupines are still common in the forested regions from Marathon County, Wisconsin, northward, and individuals are occasionally seen in Wood, Jackson, Clark and Buffalo counties, which appear to be about the southern limits of their present range in the state.

I have been unable to find any satisfactory proof of its occurrence in Illinois, although in early days it is not unlikely that it may have inhabited some of the northern counties. Kennicott writes, "I am not aware that it has been observed in northern Illinois, although it is said to inhabit Whiteside County and the banks of the Illinois River" (*l. c.*, p. 91). I have been informed that years ago it was occasionally found in Jo Daviess County, but upon investigation the evidence proved unsatisfactory. Nevertheless, Mr. Edward Grimm of Galena writes me, he believes it was formerly found in that county. In Indiana, however, its range is known to have extended to the southern portion of the state, and it was apparently not uncommon in several of the extreme western counties in close proximity to Illinois. The Prince of Wied states that it was rare in Posey County at the time of his visit to New Harmony in 1832. Evermann and Butler cite numerous records for Indiana, the latest being a specimen taken in Grant County, in 1892 (*l. c.*, p. 125); but Hahn believes it probably survived along the Kankakee River a few years later (*l. c.*, p. 532). Mr. E. J. Chansler of Bicknell, Indiana, writes me that old men told him Porcupines were common in Knox County in early days, and that Mr. T. F. Chambers saw one near Chambers Pond in that county in 1864. There are two specimens in the State Museum at Indianapolis claimed to have been taken in Laporte County, Indiana, but the date is not given. Dr. John T. Plummer states that several Porcupines were killed in the suburbs of Richmond, Wayne County, Indiana, and that he had a fine specimen in his collection captured near the town (Amer. Journ. Sci. & Arts, XLVI, 1844, p. 248).

The Porcupine is an inhabitant of the forests and spends the greater part of its time in trees. When on the ground its movements are slow and clumsy, and it appears to have little fear of man, which often leads to its undoing, as its sharp pointed quills, which are held in great

Canada Porcupine (*Erethizon dorsatum*).

respect by predatory animals, afford no defense against a rifle or shot gun. While largely nocturnal in habits, it often goes about in the daytime, and I have met with it on several occasions in the north woods, generally perched in a tree, calmly eating a late breakfast and, aside from an occasional glance in my direction, paying no attention to me whatever. If approached too closely, however, it "bristles up," elevating its quills and shaking its tail angrily, a warning which it is well to heed, for, although contrary to a popular superstition, the animal cannot eject its quills, it can strike a hard blow with its armed tail, and the sharp quills, which are loosely held in the skin, are furnished with minute barbs near the ends and make a painful wound.

Porcupines vary considerably in size, the average weight of a full grown male being probably about 16 or 18 pounds. A large one which I killed weighed 23 pounds, but Rhoads states they occasionally, when fat, reach a weight of 35 or 40 pounds.* Their favorite food seems to be the leaves, twigs and bark of the hemlock, but they also eat the leaves and bark of the maple, bass-wood, birch and other trees when those they prefer are not available. In spring and summer their food is more varied and they eat the leaves of various plants, but show a partiality to lily-pads. Beechnuts are also included in their bill-of-fare, and Dr. Merriam states he has killed several whose stomachs were distended with beechnut meal.† In Canada and in the northern portion of Michigan and Wisconsin they frequent the vicinity of lumber camps and show a decided fondness for any substance which has a salty flavor, such as old pork rinds, and they have often been known to gnaw to pieces old butter firkins and boxes which have contained salty food of any kind.

The Porcupine makes a variety of noises, the most familiar being a low whine and grunt. Audubon and Bachman state that at night it occasionally utters "a shrill note which might be called a low querulous shriek."‡

The young are born about the first of May and are generally two in number, although a litter often consists of one and sometimes three. At birth they are very large, compared to the relative size of other young animals. Dr. Merriam says, "They are actually larger and relatively more than thirty times larger than the young of the black bear at birth."§

In early days the quills of the Porcupine were much used by Indians in ornamenting baskets and embroidering skin garments, moc-

* Mamm. Penn., 1903, p. 118.

† Mamm. Adirondack Reg., 1886, p. 302.

‡ Aud. & Bach., Quadrupeds of N. Amer., I, 1846, p. 283.

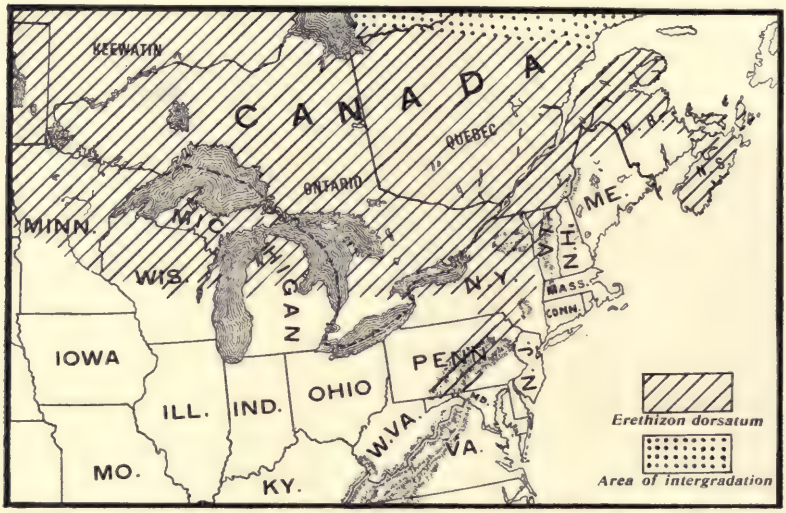
§ Mamm. Adirondack Reg., 1886, p. 305.

casins, etc. They were split and dyed a variety of colors with roots, barks and berries, some of these garments, especially those worn by chiefs, having been very elaborate and highly prized.

Albinistic examples of this animal are occasionally taken. There is an entirely white specimen in the Field Museum collection.

Specimens examined from Wisconsin:

Sayner, 2; Rummeles (skull), 1; (S. C.) Marshfield, Wood Co., 1; Clark Co., 1; (O.) Woodruff, Vilas Co., 2; Oconto Co., 1 = 8.



Map illustrating approximate range of the Canada Porcupine (*Erethizon dorsatum*) in eastern United States and Canada.

Suborder DUPLICIDENTATA.

This suborder comprises two families, the *Leporidæ* or true Hares and Rabbits; and the *Ochotonidæ* containing Picas or Tailless Hares sometimes called Chief Hares — small animals inhabiting mountain regions, several species of which occur in western North America but not within our limits. The members of the suborder are characterized by having two pairs of permanent upper incisors,* the inner ones very small and placed directly behind the others; the enamel of the incisors is continuous and not confined to the front of the teeth; the tibia and fibula are united, being anchylosed below; clavicles are present (complete in *Ochotonidæ* but incomplete in *Leporidæ*); incisive foramina of the palate large and usually confluent; bony palate short, being reduced to a narrow bridge between the premolars; postorbital processes very large in *Leporidæ* but absent in *Ochotonidæ;* testes external.

* At birth there are three pairs but the outer one on each side is soon lost.

Family LEPORIDÆ. Hares and Rabbits.

The family is nearly cosmopolitan, various species being found in North and South America, Europe, Asia and Africa, and of late years in Australia where it has been introduced. Representatives of the family thrive equally well in the tropics and in the cold regions of the North, the range of one species extending far beyond the Arctic Circle where few other mammals can exist.

In the Hares and Rabbits the skull is large and compressed behind; the supraorbital prominent, the posterior process (postorbital process) being often more or less fused to the skull; the infraorbit a foramen small land confined to lower portion of maxilla; the incisive foramina large, and the greater portion of zygoma nearly straight. The maxillary bones curiously pitted and perforated; the upper incisors sulcate; cheek teeth rootless; acromion process of scapula forked; mammæ numerous, usually five pairs; uterus completely double; clavicles present but incomplete; and the tibia and fibula united. The wrists cannot be turned as in the Squirrels to enable the animal to hold food to its mouth while eating; cheek pouches absent, but the inside of mouth partly furry. They have unusually long hind legs and ears; the soles of the feet are covered with fur. The tail is short, the eyes large, and the upper lip is deeply cleft, giving rise to the expression "hare lip" to describe a human ailment.* The dental formula is as follows: Milk dentition, I. $\frac{3-3}{1-1}$, Dm. $\frac{3-3}{2-2}$ = 18; per-

Skull of a Rabbit.

* This is of ancient origin. Topsell says, "The lippes continually move sleeping and waking, and from the slit which they have in the middle of their nose, commeth the term of hare-lips" (Historie of Foure Footed Beastes, Lond., 1607, p. 265).

manent dentition, I. $\frac{2-2}{1-1}$, Pm. $\frac{3-3}{2-2}$, M. $\frac{3-3}{3-3}=28$.

While the names, Hares and Rabbits, are often indiscriminately applied to members of the family, the first is properly restricted to those which do not use burrows in the ground and the young of which are born covered with hair and with their eyes open. Rabbits, on the contrary, use burrows and holes in the earth* and the young are born naked, with their eyes closed. Hares and Rabbits are very prolific. In many cases the young animals begin to breed when about six months old. The young number from 4 to 6 and it is claimed that two or more litters are born in a season.

In ancient times the Hare was thought to be of great therapeutic value, and Avicenna (1608), Arnoldus, Topsell and others recommend the use of various parts of its body as a cure for a long list of human ailments ranging from tuberculosis to alopecia. Regarding the treat ment of the latter, Topsell says: "The powder of the wooll of a Hare burned, mingled with the oyle of Mirtles, the gal of a Bull, and Allum warmed at the fire and annoint it uppon the heade, fasteneth the haire from falling off. . . . The head of a Hare burned and mingled with fat of Beares and vinegar, causeth haire to come where it is fallen off, and *Gallen* saith that some have used the whole body of a Hare so burned and mingled, for the foresaid cure, being layed in manner of a plaister." (Historie Foure Footed Beastes, Lond., 1607, p. 274.)

The Hare (and Rabbit†) has always played an important part in mythology and folklore.‡ Even at the present day the animal is popularly associated with paschal eggs as symbolic of the festival of Easter; and there is a wide spread superstition, especially among negroes, that the left hind foot of a Rabbit taken under certain conditions is of great value as a talisman.§

* The European Rabbit digs burrows, as do their domestic descendents in this country, but with rare exceptions indigenous North American species do not. They use holes, however, made by other animals and often enlarge them.

† Hares and Rabbits are apparently considered identical in Zoölogical Mythology.

‡ See Gubernatis, Zoöl. Mythol., London, 1872; also Massey, The Natural Genesis, London, 1883.

§ There is a curious superstition among negroes in many parts of the United States regarding the efficacy of the "left hind foot of a graveyard rabbit killed in the dark of the moon" in bringing good fortune to its possessor.

KEY TO THE GENERA.

A. Interparietal not distinct in adult; postorbital process usually nearly or quite divergent from skull; hind foot, 5 or more inches long; our species turn white in winter. Genus LEPUS, p. 261.

B. Interparietal distinct in adult; postorbital process more or less attached to the skull; hind foot, about 4 inches long in our species; do not turn white in winter. Genus SYLVILAGUS, p. 266.

(For other characters see descriptions of Genera.)

KEY TO THE SPECIES
WHICH MAY OCCUR WITHIN OUR LIMITS.

GROUP 1. Length of ear from skull to tip less than 4 inches.

Color changes from brownish in summer to white in winter; tips of ears usually edged with black; nape not rufous or decidedly different in color from the back; total length, about 17.50 to 18.50 inches; *hind foot, 5 in.* (or more); tail vertebræ, about 1.50 to 1.75 inches. Occurs in northern Wisconsin but not in southern Wisconsin or Illinois.

VARYING HARE or SNOW-SHOE RABBIT. *Lepus americanus phæonotus*, p. 262.

Rump distinctly gray or grayish, noticeably paler than back; nape usually rufous brown, quite different from color of back; tail vertebræ, about 2.25 to 2.75 inches; *hind foot, about 4 inches;* does not turn white in winter.

MEARNS'S COTTON-TAIL RABBIT. *Sylvilagus floridanus mearnsii*, p. 266.

General color brown mixed with more or less blackish; rump not distinctly gray or grayish; nape often tinged with rufous brown but not pronounced as in *mearnsi;* hind foot, about 4 inches; tail, about 2.75 inches; does not turn white in winter. Occurs in southern Illinois but not in northern Illinois or Wisconsin. SWAMP RABBIT. *Sylvilagus aquaticus*, p. 271.

GROUP 2. Length of ear from skull to tip more than 4 inches.

Ears with black tips; tail entirely white above and below; entire length, including tail, usually more than 21 inches; tail, more than 3.25 inches long. Not as yet recorded from Illinois or Wisconsin, but stragglers may occur in the extreme western portion of either state.

JACK RABBIT. *Lepus campestris*, p. 265.

Genus **LEPUS** Linn.

Lepus Linnæus, Syst. Nat., X ed., 1758, p. 57. Type *Lepus timidus* Linnæus.

Hind legs very long; ears long; tail well developed; fore feet with five toes; hind feet with four toes; soles of feet covered with hair; clavicle imperfect; interparietal not distinct in adult; supraorbitals prominent and wing-like*; the posterior process (postorbital process) usually

*See Fig. 2, p. 96.

being entirely separated from the skull but occasionally the posterior end is fused to the skull, leaving an opening or foramen; second to fifth cervical vertebræ longer than broad. This genus contains two North American subgenera, *Lepus* and *Macrotolagus*, but only the former is represented within our limits.

Dental formula: I. $\frac{2-2}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{3-3}{2-2}$, M. $\frac{3-3}{3-3}$ = 28.

Subgenus **LEPUS** Linn.

Lepus americanus phæonotus ALLEN.

VARYING HARE. SNOW-SHOE RABBIT.

Lepus americanus phæonotus ALLEN, Bull. Amer. Mus. Nat. Hist., XII, 1899, p. 11. JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 25 (Wisconsin). *Ib.*, VIII, 1910, p. 88 (Wisconsin). NELSON, N. Amer. Fauna, No. 29, 1909, p. 95 (Wisconsin, Minnesota, Michigan, etc.).

Lepus americanus KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 84 (Wisconsin).

Lepus Americanus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 440 (Wisconsin).

Type locality — Hallock, Kittson Co., Minnesota.

Distribution — Northern Wisconsin and the western portion of the Michigan peninsular, northern Minnesota, southern Manitoba and a small portion of western Ontario.

Description — *In summer:* Upper parts brown and ochraceous buff, more or less mixed with dusky and with indications of a blackish line down the middle of the back; upper surface of tail brownish buff or brownish gray mixed with dusky; upper portions of legs tinged with rusty brown; ears narrowly bordered with black, the extreme edge on inner side often whitish; under parts, except throat, white; throat, except extreme upper part and chin, brownish buff; upper portion of hind feet tawny buff.

In winter: General color pure white, except tips of ears, bordered with black, and often with the front of the ears more or less tinged with brownish buff. In spring and fall it is a parti-colored animal, showing irregular markings of brown and white during the transition period, when the semi-annual molt of pelage and change in color takes place.*

Measurements — Total length, about 18 in. (460 mm.); tail vertebræ, about 1.50 in. (38 mm.); hind foot, 5.25 in. (134 mm.).

* Dr. J. A. Allen has ably demonstrated that this change of color is due to a new growth of hair each season and not to a change of color in the old pelage (Bull. Amer. Mus. Nat. Hist., VI, 1897, p. 107).

Summer. Varying Hare (*Lepus americanus phæonotus*). Winter.

The Varying Hare, or Snow-shoe Rabbit as it is often called, is common in northern Wisconsin, its range being restricted to about the northern half of the state. There are specimens in this Museum from Douglas and Vilas counties and I have seen others from Barron, Langlade and Iron counties. Nelson records it from Bayfield and Douglas counties, and Jackson gives it as abundant in Ashland, Bayfield and Douglas counties (*l. c.*, 1910, p. 88). Notwithstanding the fact that I have made numerous inquiries of a number of hunters in various parts of southern Wisconsin, I have failed to learn of its occurrence in that portion of the state. In early days, however, its range may have extended farther south, as Kennicott states it was "not uncommon in central and northern Wisconsin and considerable numbers are found in the southern part of the state." He also says: "It has been stated that a number were shot on the present site of the City of Chicago in the winter of 1824" (*l. c.*, p. 85).

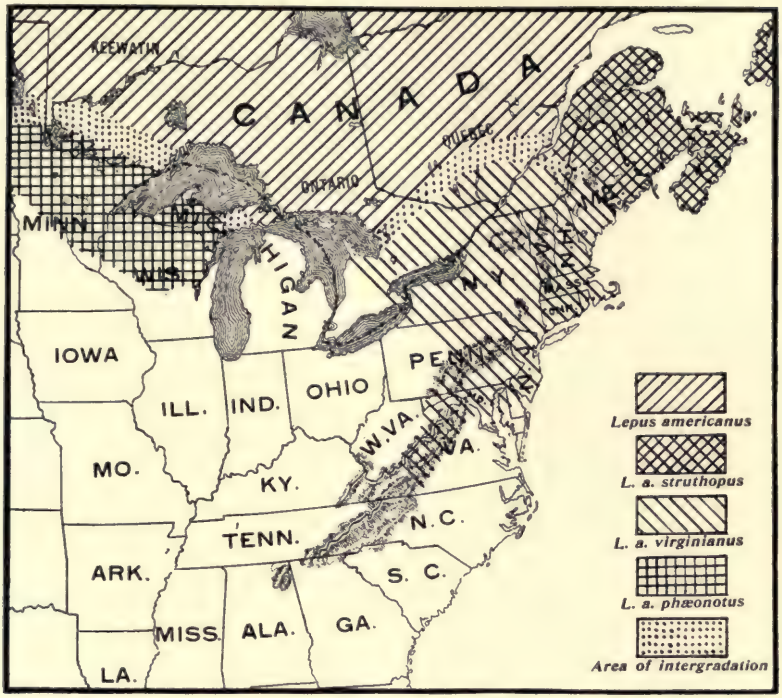
The Varying Hare prefers a wooded country where there are numerous thickets of dense undergrowth. In winter, when the ground is frozen, it seems to be more numerous in swamps where there is a heavy growth of timber. While it may occasionally be seen in the daytime, it feeds chiefly at night and, unlike the Cotton-tail, this species does not seek shelter in holes in the ground. The nest is a mass of grass covered with soft fur supplied by the mother. It is usually well concealed under a bush or in a thick growth of weeds, and on one occasion I found one in the base of a hollow tree. The young are generally 2 to 4 in number, rarely 5 or 6, and are covered with hair when born, and the eyes are open.

The food of the Varying Hare consists largely of grasses, clovers and leaves of various shrubs; they also eat the bark of young trees. In settled districts they eat the bark of fruit trees and grape vines and often do considerable damage to garden crops.

The skins of these animals are of comparatively little commercial value, as they are tender and easily torn, but they are made into exceedingly warm blankets and robes by the Indians, who cut the skins into strips which they braid and fasten together. Such blankets are much sought after by hunters and prospectors in the far North.

Specimens examined from Wisconsin:

Woodruff, Vilas Co., 2; Sayner, Vilas Co., 2; Solon Springs, Douglas Co., 8; Lac Vieux Desert, Vilas Co., 1; (M. P. M.) Eagle River, Vilas Co., 1; (O. C.) St. Croix River, Douglas Co., 1; Turtle Lake, Barron Co. (skulls), 5; Mercer, Iron Co. (skull), 1; Fisher Lake, Iron Co., 2 (1 skull); Langlade Co. (skulls), 5 = 29.



Map illustrating the approximate distribution of Varying Hares (*Lepus americanus* and races) in eastern United States and Canada.

Lepus americanus ERXLEBEN. (Syst. Regni Anim., I, 1777, p. 330.) Type locality — Probably in the vicinity of Fort Severn, Keewatin, Canada. *In summer*, upper parts grayish brown; less ochraceous than *virginianus*. *In winter*, white. Total length, about 18.50 inches.

Lepus a. struthopus BANGS. (Proc. Biol. Soc. Wash., XII, 1898, p. 81.) Type locality — Digby, Nova Scotia, Canada. Size about the same as *americanus*, but browner in summer and ears longer.

Lepus a. virginianus (HARLAN). (Fauna Amer., 1825, p. 196.) Type locality — Blue Mountains, near Harrisburg, Pennsylvania. Largest and most richly colored of the *americanus* group; average length, 20 inches or more.

Lepus a. phæonotus ALLEN. Type locality — Hallock, Kittson Co., Minnesota. Paler and more buffy brown in summer than *americanus*, but often showing a slight tinge of rusty; size about the same. Description and measurements as previously given.

Lepus campestris BACHMAN, JACK RABBIT, OR JACKASS RABBIT, as it is popularly known, although not as yet recorded from Illinois or Wisconsin, has been taken in the eastern border of Iowa at Muscatine, and in extreme southeastern Minnesota near Laneboro. It may be recognized by its large size; its very long black-tipped ears; and its long, *entirely white tail*, which has a length of 3.50 or more inches, and

which will distinguish it from the Varying Hare, the only one of our species with which it might be confounded.

Genus **SYLVILAGUS** Gray.

Sylvilagus Gray, Ann. & Mag. Nat. Hist., 3rd Ser., XX, 1867, p. 221.
Type *Sylvilagus floridanus mallurus* (Thomas).

Interparietal distinct in adults; supraorbital prominent, but the postorbital process slenderer and more pointed, and more fused to the skull than in *Lepus;* occasionally the opening or foramen, usually separating the middle portion of the process from the skull, is very small or entirely absent; second to fourth cervical vertebræ with dorsal surface flattened and shorter than broad; only one annual molt; does not turn white in winter; also other skeletal differences (described and illustrated by Nelson, N. Amer. Fauna, No. 29, 1909, pp. 39–40). Two subgenera are recognized, *Sylvilagus* and *Tapeti.*

Dental formula: I. $\frac{2-2}{1-1}$, C. $\frac{0-0}{0-0}$, Pm. $\frac{3-3}{2-2}$, M. $\frac{3-3}{3-3}$ = 28.

Subgenus **SYLVILAGUS** Gray.

Brain case higher and comparatively broader and whole skull relatively lighter and more slender than in *Tapeti;* tail and feet more thickly haired; pelage softer.

Sylvilagus floridanus mearnsii (ALLEN).

MEARNS'S COTTON-TAIL RABBIT. GRAY RABBIT.

Lepus sylvaticus mearnsii ALLEN, Bull. Amer. Mus. Nat. Hist., VI, 1894, p. 171 (footnote). ELLIOT, Field Columb. Mus. Pub., Zoöl., I, 1898, p. 220, (Iowa).

Lepus nanus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 340 (Wisconsin).

Lepus sylvaticus KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 77.

Sylvilagus floridanus mearnsi SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 124 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 25 (Wisconsin). *Ib.*, VIII, 1910, p. 89 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 534 (Indiana). NELSON, N. Amer. Fauna, No. 29, 1909, p. 169 (Indiana, Illinois, Wisconsin, Michigan, Minnesota, Iowa, Kentucky, Tennessee, etc.). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 32 (Missouri, Illinois).

Type locality — Ft. Snelling, Minnesota.

Distribution — From north-central Kentucky, southern Illinois, central Missouri, northeast to Toronto, Canada, and north to northern Wisconsin and central Minnesota, west to Nebraska and Kansas.

Description — General color above pale tawny brown, the hairs tipped with black; sides of body paler; *nape distinctly tinged with rufous brown or rusty brown*, quite different from the color of the back; *rump gray* mixed with dusky, caused by the grayish hairs being tipped with black; upper surface of tail grayish brown, under surface white; belly white; under side of neck brownish buff; upper surface of legs pale rusty brown. Does not turn white in winter.

Remarks — Nelson states (*l. c.*, p. 174) that *S. f. alacer* occurs in "extreme southern Illinois," but does not include Illinois specimens in his list of material examined. All the specimens in the Field Museum collection from the most southern counties should undoubtedly be referred to *mearnsii*.

Measurements — Total length, about 17.75 in. (451 mm.); tail vertebræ, 2.30 in. (60 mm.); hind foot, 4 in. (101 mm.).

Field measurements of 6 specimens taken in southern Illinois by E. Heller:

No.	Place.	Date.	Total Length.	Tail Vertebræ.	Hind Foot.
15403, ♀,	Olive Branch, Ill. . .	Nov. 26, 1906	465 mm.	65 mm.	105 mm.
15282, ♂,	Golconda, Ill.	Apr. 12, 1907	445 "	61 "	92 "
15795, ♂,	Ozark, Ill.	Apr. 21, 1907	460 "	71 "	95 "
15788, ♂,	Golconda, Ill.	Apr. 11, 1907	450 "	60 "	97 "
15793, ♀,	Reevesville, Ill.	Apr. 18, 1907	460 "	68 "	96 "
15790, ♂,	Reevesville, Ill.	Apr. 17, 1907	475 "	60 "	99 "

Average measurements of 10 specimens from different localities in Wisconsin:

Total length, 455 mm.; tail vertebræ, 61 mm.; hind foot, 103 mm.

Mearns's Cotton-tail Rabbit, Cotton-tail or Gray Rabbit as it is variously called, is our most common species. In fact it is the only representative of the family which occurs in northern Illinois and southern Wisconsin. It is found throughout Illinois and Wisconsin, possibly excepting the extreme northeastern portion of the latter state, but it is not unlikely that its range will be found to include all of the northern counties. Specimens have been examined from a large number of localities throughout both states, ranging from Alexander and Johnson counties in extreme southern Illinois to Douglas and Oconto counties in northern Wisconsin. Although still abundant at the present time in many localities in the vicinity of Chicago, its numbers were evidently much greater thirty years ago. Brayton (1882) states: "They were worth in the Chicago market from five to fifteen cents apiece, according to the abundance or the state of the weather. I have seen them, when frozen in large boxes, sold by the cubic foot, and shipped from Chicago to New York City."*

* Geol. Surv. Ohio, IV, Pt. 1, 1882, p. 188.

Mearns's Cotton-tail Rabbit (*Sylvilagus floridanus mearnsii*).

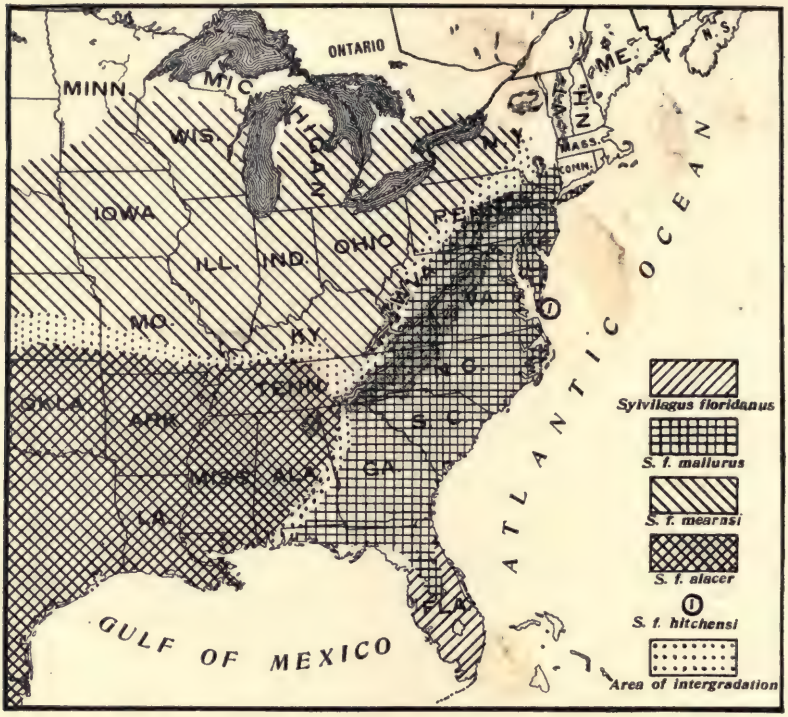
This Rabbit is most commonly found in woods where there are numerous thickets and in open country where there is plenty of underbrush. It is not a burrowing animal in the strict sense of the word, as it does not dig burrows, but it often occupies holes in the ground and hollow trees and logs, and when pursued will almost invariably seek refuge in such places when available. In this connection Nelson says: "In some cases they enlarge burrows or dig the dirt from between rocks or under boards to make an entrance under a house, but appear never to make entirely new burrows" (*l. c.*, p. 22).

The Cotton-tail is a gentle, timid animal and when caught it never attempts to bite but generally utters a sharp squeal of fear. When suspicious or angry it has the habit of stamping the ground with its hind feet like our domestic descendants of the European species. The life of the Rabbits is by no means easy; practically all carnivorous mammals prey upon them, as well as the larger hawks and owls; Minks and Weasels hunt them persistently and destroy a great many. They are very prolific, however, 4 to 6 young being born at a birth, and there are often three litters during a season. The nest is usually a mat of grass and leaves lined with soft fur from the pelage of the mother, and is placed on the ground concealed under bushes or weeds. According to Nelson the young, when born, are naked and their eyes are closed (*l. c.*, p. 14). They are suckled and cared for by the mother for three or four weeks, after which they are left to care for themselves. When feeding and undisturbed these animals move about slowly with short hops, advancing about a foot at a time, but when frightened or pursued by dogs they can run fast for a short distance. Their long muscular hind legs enable them to make leaps of from 8 to 10 feet, as shown by tracks in the snow.

The food of the Cotton-tail consists principally of grass, leaves of shrubs and tender buds, as well as the bark of trees. In cultivated districts they frequently do considerable damage to vegetable gardens and fruit trees. Lantz says,* "The common cottontail is fond of frequenting farms and plantations and makes its 'forms' under brush heaps or in tufts of grass, bunches of weeds, briars, or bushes. . . . It occupies this form, or nest, by day and at night moves about, feeding upon the succulent vegetables in the farmer's garden, or the clover, turnips, or corn in his fields. In the fall it feasts upon apples, cabbages, turnips and the like left exposed in garden and orchard; and in winter, when all else is frozen hard or covered with snow, it turns its attention to twigs and bark of woody plants, often doing much damage to young trees."

For the benefit of fruit-growers I quote the formula of a wash given by Lantz (*l. c.*, p. 340), which has proved efficacious in protecting the

* Yearbook Dept. Agr., 1907, p. 331.



Map showing supposed distribution of Cotton-tail Rabbits belonging to the subgenus *Sylvilagus* in eastern United States.

Sylvilagus floridanus (ALLEN). (Bull. Amer. Mus. Nat. Hist., 1890, p. 160.) Type locality — Sebastian River, Brevard Co., Florida. Size small; total length, about 16 or 17 inches; color grayish brown or rusty brown; legs and nape rufous brown.

Sylvilagus f. mallurus (THOMAS). (Ann. & Mag. Nat. Hist., 7th ser., II, 1898, p. 320.) Type locality — Raleigh, North Carolina. Larger than *floridanus* and ears longer; color paler.

Sylvilagus f. mearnsii (ALLEN). Type locality — Fort Snelling, Minnesota. Description as previously given. Total length, about 17.50 in.; tail vertebræ, about 2.75 in.; hind foot, about 4 in.

Sylvilagus f. alacer (BANGS). (Proc. Biol. Soc. Wash., X, 1896, p. 136.) Type locality — Stilwell, Oklahoma. Smaller than *mearnsii;* size about the same as *floridanus;* upper parts more reddish brown than *mearnsii;* total length, about 16.75 in.; tail vertebræ, 2.25 to 2.50 in.; hind foot, 3.75 in.

Sylvilagus f. hitchensi MEARNS. (Proc. U. S. Nat. Mus., XXXIX, 1911, p. 227.) Type locality — Smiths Island, Northampton Co., Virginia. Size of *mallurus* but paler, with upper parts sandy fulvous and skull and teeth larger.

trunks of fruit trees from the depredations of these animals as well as from mice:

Unslacked lime.....20 pounds,
Flowers of sulphur.....15 pounds,
Water to make.....45 to 50 gallons.

This will make a quantity about sufficient to fill an ordinary kerosene barrel. Lantz says, "A little salt may be added to increase the adhesive property of the mixture. The lime, sulphur, and about a third of the water are boiled together for at least one hour, and the full quantity of the water is then added. For San José scale the wash in the form of a spray is applied to the entire surface of the trees. For protection from mice and rabbits the trunks only require treatment, and the wash may be applied with a brush. One application in November should last the entire winter."

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Camp Logan, Lake Co., 1; Olive Branch, Alexander Co., 3; Reevesville, Johnson Co., 4; Ozark, Johnson Co., 2; Golconda, Pope Co., 3 = 13.
Wisconsin — Beaver Dam, Dodge Co., 5; (M. P. M.) Milwaukee Co., 1; Jefferson Co., 1; Genoa, Vernon Co., 5; Waukesha Co., 1; Upper St. Croix Lake, Douglas Co., 1; Kelly Brook, Oconto Co., 10; Grant Co., 9; Racine Co., 2; Prescott, Pierce Co., 5; Delavan, Walworth Co., 2; (O. C.) Turtle Lake, Barron Co. (skulls), 7; Colfax, Dunn Co. (skulls), 9 = 58.
Indiana — La Porte, 1.
Iowa — Knoxville, 5.
Minnesota — Ft. Snelling, 1.

Subgenus **TAPETI** Gray.

Brain-case depressed and comparatively narrow; supraorbital flattened; anterior process of zygomatic arch with sharp edge; pelage coarse; feet more thinly haired than in subgenus *Sylvilagus;* tail short.

Sylvilagus aquaticus (BACH.).

SWAMP RABBIT.

Lepus aquaticus BACHMAN, Jour. Acad. Nat. Sci. Phila., VII, 1837, p. 319. KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 85. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 538 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 63 (Tennessee, Mississippi, etc.).

Sylvilagus aquaticus NELSON, N. Amer. Fauna, No. 29, 1909, p. 270 (Illinois, Missouri, Tennessee, etc.). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 31 (Missouri, Kentucky, Illinois).

Swamp Rabbit (*Sylvilagus aquaticus*).

Type locality — Supposed to be western Alabama.

Distribution — Eastern Texas and Oklahoma, nearly the whole of Alabama, Mississippi and Louisiana (except on the coast), extreme western Georgia and the greater portion of Arkansas, and northward in western Tennessee and Kentucky to southern Illinois.

Description — General color of upper parts ochraceous brown, the hairs tipped with black; nape, rump, upper sides of legs and upper surface of tail plain ochraceous brown (not gray or grayish as in *mearnsi*) often tinged with rusty; under side of neck buffy brown; rest of under parts, including under surface of tail, white.

Measurements — Total length, about 20.50 in. (521 mm.); tail vertebræ, 2.75 in. (69.8 mm.); hind foot, 4.12 in. (104.8 mm.).

Habitat — Low swampy woods and bottom lands about rivers and lakes.

The Swamp Rabbit is a southern species found within our limits only in the extreme southern part of Illinois. According to Howell the northern limit of its range in the state is within a few miles of Grand Tower, Jackson County, and a point about five miles below Golconda in Pope County.

This species prefers low swampy woodlands and bottom lands in the vicinity of water, but I have taken it in the South in comparatively high dry woods along river banks but never far from water.

Audubon and Bachman say, "When chased by dogs, the Swamp-Hare runs with great swiftness and is able to escape from them without difficulty; but it almost invariably directs its flight towards the nearest pond, as if led by instinct to seek an element in which all traces of its scent are soon lost to its eager pursuers. . . . We have been informed that it is a very common habit of this species when pursued, to swim to the edge of some stream or pond, retreat beneath the overhanging roots of the trees that may be growing on its border, or seek for a secure shelter under the hollows made by the washing of the banks. The swiftness of foot possessed by this Hare, and the stratagems to which it is capable of resorting, might easily enable it to elude pursuit but for this habit of seeking for shelter as soon as it is chased, which is the cause of its being frequently captured."*

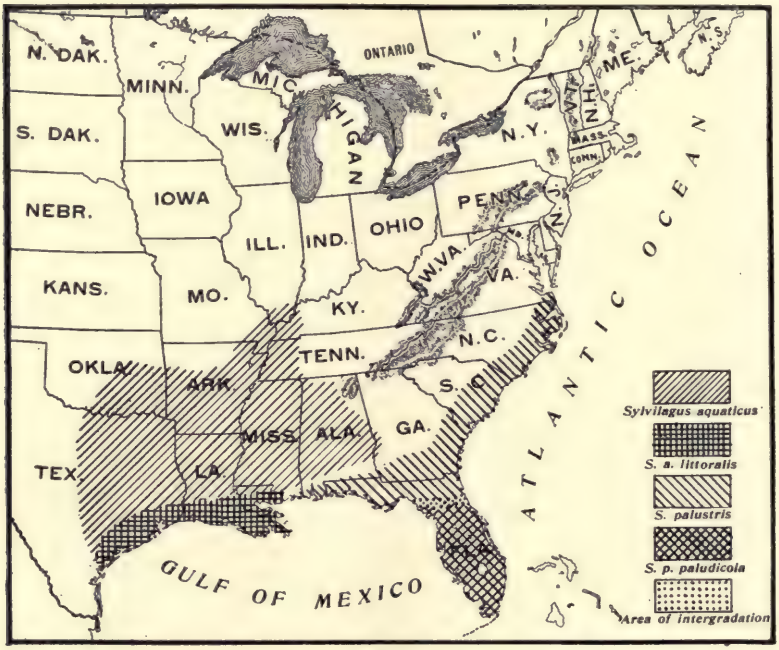
I have never found a nest of this Rabbit, but according to Nelson it differs but little from that of the Cotton-tail. He says, "J. D. Mitchell of Victoria, Texas, informs me that the nesting habits of the swamp rabbit are identical with those of the Cotton-tail (*S. f. chapmani*) except that the nest is considerably larger and is placed in dry places in river bottoms near a fallen log, dead stump, or pile of trash. He

* Quadrupeds N. Amer., I, 1846, p. 289.

states further that the young, as in the case of the Cotton-tail, are born naked, blind and helpless" (*l. c.*, p. 273).

Specimens examined from Illinois:

Reevesville, Johnson Co., 2; Olive Branch, Alexander Co., 3 = 5.



Map illustrating the approximate distribution of the Swamp and Marsh Rabbits belonging to the subgenus *Tapeti*.

Sylvilagus aquaticus (BACHMAN). Type locality — Supposed to be western Alabama. Description as previously given.

Sylvilagus a. littoralis NELSON. (N. Amer. Fauna, No. 29, 1909, p. 273.) Type locality — Houma, Louisiana. Size of *aquaticus*, but color more reddish and decidedly darker.

Sylvilagus palustris (BACHMAN). (Jour. Acad. Nat. Sci. Phila., VII, 1837, p. 194.) Type locality — Coast of South Carolina. Smaller than *aquaticus* and under side of tail grayish.

Sylvilagus p. paludicola (MILLER & BANGS). (Proc. Biol. Soc. Wash., IX, 1894, p. 105.) Type locality — Fort Island, near Crystal River, Citrus Co., Florida. A dark reddish brown form with short, broad ears.

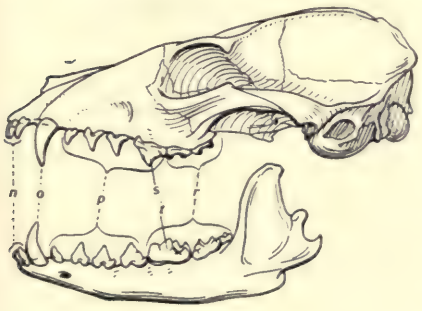
Order FERÆ.

THE FLESH EATERS.

Suborder FISSIPEDIA.

The order Feræ, formerly known as Carnivora, contains the Flesh Eaters or Beasts of Prey, which are widely distributed nearly throughout the world.* The order is divided into two suborders: the Pinnipedia, containing the marine Seals and Walruses; and the Fissipedia, which is the one that comes within the scope of the present work and which includes all the other known living forms belonging to the order, such as Lions, Tigers, Cats, Bears, Wolves, Foxes, Skunks, Weasels, etc.

While all the members of the order are flesh eaters, some of them, like the Bears, are practically omnivorous and others vary their diet with roots, fruits and berries. The dentition is especially adapted to their mode of life; the canines are prominent, being large, sharp, and, as a rule, somewhat recurved.† The incisors are pointed and are six in number in each jaw (with rare exceptions); the cheek teeth (molars and premolars) are unusually modified. The last premolar in the upper jaw and the first true molar in the lower jaw are generally (but not always) decidedly larger and longer than the rest of the cheek teeth and are known as carnassial or sectorial teeth. All the teeth in front of the carnassial teeth have cutting edges; the only teeth having broad crowns are those situated behind the carnassials. The skull is furnished with ridges to which are attached the powerful jaw muscles. The radius and ulna are separate and the clavicles are more or less rudimentary or absent. The toes are armed with strong claws, which vary in shape in different animals. Some are curved and some nearly straight. In the Cats, for example, they are strongly curved, sharp and retractile, being drawn back and sheathed when not in use. There is a wide diversity in size, shape and habits among members of



Skull of a Fox.
n, Incisors; o, canines; p, premolars; r, molars; s, upper carnassial; t, lower carnassial.

* The Australian region would be excepted, if the Dingo of that country be considered an introduced species.

† The Sabre-toothed Tiger, a fossil species belonging to this order, the remains of which have been found in Pleistocene deposits in some parts of the United States and elsewhere, had the canine teeth enormously developed, reaching a length of 7 or more inches.

Skulls of Carnivores.
1, Badger (*Taxidea*); 2, Otter (*Lutra*); 3, Wild Cat (*Lynx*).
(About ⅔ nat. size.

this order; some, like the Bears, are plantigrade, walking on practically the entire sole of the foot; others, like the Wolves and Cats, are digitigrade and walk on the toes; while still others are strictly neither one nor the other and are often considered as semi-digitigrade. The various differences, however, will be treated under the different families and genera and need not be further discussed here.

The stomach is simple and a cæcum is present in all of our species except those belonging to the *Ursidæ*, *Procyonidæ* and apparently the *Mustelidæ*. The uterus is bicornate; placenta deciduate and usually zonary; the mammæ vary in number but are always abdominal.

KEY TO OUR FAMILIES.

GROUP 1. Digitigrade mammals.

A. Form cat-like; claws sharp, strongly curved and retractile
Family FELIDÆ. Cats, p. 277.

B. Form dog-like; claws non-retractile and not strongly curved.
Family CANIDÆ. Wolves, Foxes, etc., p. 296.

GROUP 2. Plantigrade or semi-plantigrade mammals.

PART 1. Tail annulate (marked with alternate transverse light and dark rings).

A. Tail bushy; molars $\frac{2-2}{2-2}$ **Family PROCYONIDÆ. Raccoons,** p. 391.

PART 2. Tail never annulate.

A. Size very large; molars $\frac{2-2}{3-3}$ **Family URSIDÆ. Bears,** p. 396.

B. Size variable; molars $\frac{1-1}{2-2}$ **Family MUSTELIDÆ. Otters, Minks, Weasels, Skunks, Badgers, and Wolverine,** p. 327.

Family FELIDÆ. The Cats.

This family, which is probably the most highly specialized of the order, contains the Cats, both great and small, such as Lions, Tigers, Panthers, Wild Cats or Lynxes, etc.

In all the species the canine teeth are highly developed and most of the cheek teeth are sharp edged, being especially adapted for cutting. The claws are curved, sharp and retractile, and capable of being drawn back or extended at the will of the animal. Ordinarily the claws are tipped backward and are protected by a sheath, being nearly or quite concealed, so that no claw marks are shown in the tracks made by the animal when walking. When needed for use, they are tipped forward and downward by contraction of the powerful flexor muscles.

The clavicles are more nearly developed than in others belonging to the order, but do not articulate with the sternum or scapula. The skull is short and rounded; the bullæ much inflated. The tongue is rough, being covered with sharp, hard papillæ which point backwards.* The heel does not touch the ground in walking (digitigrade). The front feet have five and the hind feet four toes; a cæcum is present but small; other characters as given for the order.

Their food consists principally of animals which they have killed. They are largely nocturnal in habits and, with few exceptions, are more or less arboreal.

Representatives of this family are found in a wild state throughout the greater portion of the world, except in Australia and Madagascar. Two genera and some 20 or more species and subspecies occur in North America, and three species have been recorded within our limits.

The origin of the Domestic Cat is uncertain, but it is generally supposed to have decended from an African species (probably *F. caffra* or a closely allied form), which had become domesticated in Egypt at a very early period† and was undoubtedly introduced in Europe, where it may, or may not, have interbred with the Wild Cat (*F. cattus*) of that country. That Domestic Cats were held in high esteem in Britain in ancient times is shown by an old Welch law‡ in force during the reign of Hoel dda, or Howel the Good, who died A. D. 948, enacting that, if any one stole or killed the animal guarding the prince's granary, he was to forfeit a milk ewe, its fleece and lamb, or as much wheat as when poured on the Cat suspended by its tail, the head touching the floor, would form a heap high enough to cover the tip of the tail.

During the following 600 years, however, their pecuniary value decidedly decreased and in Topsell's time (1607) they had acquired a somewhat unsavory reputation in many countries.§ That ancient writer devotes a number of pages to describing their habits, and judging from his account of them, they differed but little from those of their descendents at the present day. For example, he states that they are

* Noticeable when the hand is licked by a Domestic Cat and, of course, much more pronounced in larger animals belonging to the family; the tongue of a Lion would tear the skin.

† Cats were held sacred by the ancient Egyptians and many of their mummies have been found. Ælianus tells us that at Bubastis (later known as Tel Basta) consecrated Cats were fed upon fish kept in reservoirs for the purpose (De Animalium Natura, 1616).

‡ Quoted by Thomas Pennant, British Zoölogy, I, 1776, pp. 69, 70.

§ Cats were objects of superstition, being regarded as the familiars of witches and Satan was supposed to assume the shape of a black Cat. Among the many popular superstitions which obtain even at the present day may be cited: That a Cat "sucks" a baby's breath; that it has nine lives; that, if when washing its face its paws are extended above its head, rainy weather may be expected; that a black Cat crying on the roof of a house is a sinister omen, and many others equally absurd.

extremely fond of the Valerian plant; that they lie on their backs and play with a string; that they torment a wounded mouse and do not kill it for a time, knowing it cannot escape, but that they kill a captured bird at once; he also informs us that the males wander forth at night and at certain times, "commonly called cat-wralling," they have a "peculiar direfull voyce."

KEY TO THE GENERA.

Size large; tail more than 15 inches long; three premolars and one molar on each side of upper jaw. Genus FELIS, p. 279.

Size medium; tail less than 15 inches long; only two premolars and one molar on each side of upper jaw. Genus LYNX, p. 286.

KEY TO SPECIES.

GROUP 1. Tail more than 15 inches long; total length more than 60 inches; premolars $\frac{3-3}{2-2}$; total teeth 30.

Size large; tail long; general color tawny or grayish brown.
PANTHER or COUGAR.
Felis couguar, p. 280.

GROUP 2. Tail less than 15 inches long; total length less than 50 inches; premolars $\frac{2-2}{2-2}$; total teeth 28.

Color grayish; feet very large; tail less than 5 inches long (to end of tail bone); no brown band or collar on throat; ear tufts usually 1.50 to 2 inches long; end of tail wholly black. CANADA LYNX. *Lynx canadensis*, p. 287.

Color pale rufous brown mixed with grayish, more or less dark spots or streaks on head and legs; throat with distinct pale brown collar; belly white, usually with more or less dusky spots; end of tail not entirely black, the under side being white. WILD CAT, BAY LYNX. *Lynx ruffus*, p. 291.

Subfamily FELINÆ.

Genus **FELIS** Linnæus.

Felis Linnæus, Syst. Nat., X ed., I, 1758, p. 41. Type *Felis catus* Linn.

Body comparatively slender and long; tail long, more than ⅓ total length; face short and rounded; ears not tufted; claws completely retractile; zygomata wide; bullæ large; three premolars on each side of upper jaw; upper carnassial with distinctly cusped inner tubercle; other characters as given for the family.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{2-2}$, M. $\frac{1-1}{1-1}=30$.

Felis couguar KERR.

EASTERN COUGAR. PANTHER.

Local names — Panther, Cougar, Mountain Lion, Painter.

Felis couguar KERR, Anim. Kingd., 1792, p. 151. MERRIAM, Proc. Wash. Acad. Sci., 1901, p. 582. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 540 (Indiana).

Felis concolor LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 653 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 181 (Iowa). HOY, Trans. Wis. Acad. Sci., Arts & Letters, V, 1882, p. 256 (Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 41 (Iowa). *Ib.*, Annals of Iowa, 3rd ser., VI, No. 8, 1905, p. 562 (Iowa). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 66 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 138 (Indiana). BUTLER, Proc. Ind. Acad. Sci., 1894 (1895), p. 85 (Indiana). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 2 (Kentucky). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 201 (Tennessee).

Type locality — Pennsylvania.

Distribution — Formerly throughout eastern North America, from about the Canada line south to the Gulf states; replaced in the West and in Florida by slightly different geographical races.

Description — Size large; tail long; general color pale tawny brown or grayish brown, middle of back darker than the rest; under parts pale; tail tipped with black; ears without tufts of long hair. The young are spotted.

Measurements — Total length (ordinary size), 6.50 to 7.50 feet; tail vertebræ, 28 to 34 inches; hind foot, about 10 inches.

The Panther, or Cougar, was formerly not uncommon throughout the wooded portions of Illinois and Wisconsin. The fact that it was considered rare by some of the early writers has little weight, inasmuch as its habits were such that, in a country where the character of the soil and vegetation were such that its tracks could not be seen, its presence would be very likely overlooked;* but as the country became settled, they were driven out or killed and it is extremely doubtful if any exist within our limits at the present time.

Referring to early writers, Woods (1822) says,† "Of panthers I

* As illustrating this, I may say that I hunted for many years in southern Florida where Panthers were common, so much so that rarely a day passed without finding the tracks of one or more of these animals either on the sandy ridges or in the soft ground bordering the cypress swamps, and yet for two seasons not a single one of these big Cats was seen. It was only after a pack of trained hounds had been pressed into service that three were killed in one week in the same locality.

† Woods, J. Two Years' Residence in the Settlement on English Prairie in the Illinois Country, 1820–21 (1822), p. 190.

Panther or Cougar (*Felis concolor*).

have seen nothing and heard but little; a noted hunter told me he had followed hunting steadily (an American phrase) for twenty years, and had never seen one; but that others who had hunted but little, had sometimes killed one." Kennicott (1854) says, "A single individual has been known in the county" [Cook Co.]. (*l. c.*, p. 578.) Thomas (1860) says, "Very few if any found in the state (Illinois), though it has occasionally been seen within the last few years (*l. c.*, p. 653).

Mr. J. E. Andrews writes me that the last Panther was killed in Macoupin County, Illinois, about 1840; and Mr. C. J. Boyd of Anna, Illinois, informs me that one was killed east of Thebes in Alexander Co., about 1862. Judge R. M. Barnes of Lacon, Illinois, writes me that his grandfather killed one northeast of Galena, Jo Daviess Co., about 1840, but he is in doubt as to the exact year. There have been rumors of these animals having been observed in southern Illinois at a much later date; but all rest upon hearsay evidence and are of comparatively little value. Nevertheless, from among a number of letters I have received from residents in that locality, two at least are worthy of mention: Mr. J. C. Baker of Golconda, Illinois, writes that he is informed upon good authority (and has faith in the statement) that a Panther was seen in Pope County in the fall of 1905; and Mr. A. W. Williams of Ava, Jackson Co., writes, "We still hear of people seeing Panthers occasionally among the hills and bluffs of the Mississippi River."

Hahn is of the opinion that these animals became extinct in Indiana about the year 1850 (*l. c.*, p. 540). Mr. E. J. Chansler, an old resident of Bicknell, Indiana, writes me that he has records of at least three Panthers having been seen or killed in Knox and Daviess counties in that State, the latest being one near Vincennes, in 1837, by Felix Bouchie.

In Wisconsin we have reason to believe that a few individuals existed until a comparatively recent date. Dr. Hoy (1882) says, "A few panthers, *Felis Concolor*, are yet with us; a straggler is occasionally seen. Benjamin Bones of Racine shot one on the head waters of Black River, December, 1863." (*l. c.*, p. 256.) Strong (1883) says, "Found rarely in the northern part of the state." (*l. c.*, p. 436.) Mr. E. C. Bratlie of Westly informs me that a Panther was killed in Vernon County a few miles from his town about forty years ago(1870?). Mr. George A. Williams of Kremlin, Marinette Co., writes, "Two Panthers were seen by Nelson and Albert Chapman and Ray Williams in this county on January 2, 1909. This information is reliable." Mr. Daniel Farnham of Manly, Douglas Co., writes, "There was a Panther killed in Douglas County about three or four years ago and one shot at last winter but not killed." While records of animals seen and not killed are unsatisfactory from a scientific standpoint, owing to possible error

in identification,* they are of interest, coming, as they do, from trustworthy men who are honest in their convictions.

Herrick states that an animal of this species was killed in Sunrise, Chisago Co., Minnesota, in 1875. (*l. c.*, p. 68.)

Panthers are shy animals and on account of their nocturnal habits are rarely seen even where they are not uncommon. As a rule they do their hunting at night or after sunset and very early in the morning, but on cloudy days or after a rain they often move about in the daytime. They are great wanderers, rarely staying long in one place unless attracted by an unusual abundance of game or during the breeding season. They prey alike upon large and small animals. Rabbits and Gophers are often killed by them and occasionally a Porcupine is added to the list, in spite of the fact that the destruction of the latter is often attended with unpleasant results, as Dr. C. Hart Merriam tells us:† "It often happens that a Panther is killed whose mouth and lips and sometimes other parts also, fairly bristle with the quills of this formidable rodent. Porcupines are such logy, sluggish creatures, that in their noctivagations they fall an easy prey to any animal that cares to meddle with them."

While there is no doubt that Panthers kill a great many small mammals, they are fond of larger game such as Deer, Sheep and Hogs, when they can get them. In the vicinity of ranches they are undesirable neighbors, as they will kill dogs and colts, and it is claimed when pressed by hunger they will attack full grown cattle and Elk. While hunting in the vicinity of the McCloud River, California, in the "eighties," the ranchmen complained to me of the number of colts that had been killed by Panthers. One man informed me he had lost five colts and several calves that season. If a Panther kills an animal sufficiently large to furnish more than one meal, such as a Deer or a Sheep, he returns to it the second night but rarely the third night in localities where game is plenty, and much of it is often left uneaten. In Florida, where a slightly different race occurs but whose habits probably differ but little from the northern form, I have on two occasions found a partly eaten Deer in a state of decomposition, which had evidently been left by a Panther. Another time I found a half-eaten fawn which had apparently been killed the previous night. The Panther came back sometime during the night, but did not attempt to touch the fawn, being ev-

* On one occasion in Florida, while accompanied by an Indian, I had a momentary glimpse of a brown animal as it sank down behind a clump of palmettos, and we both believed it to be a Panther. Upon stalking it, however, we were astonished to discover it to be a half-grown Deer. The fact that it attempted to hide instead of running away aided in the deception.

† Mamm. Adirondack Reg., 1886, p. 30.

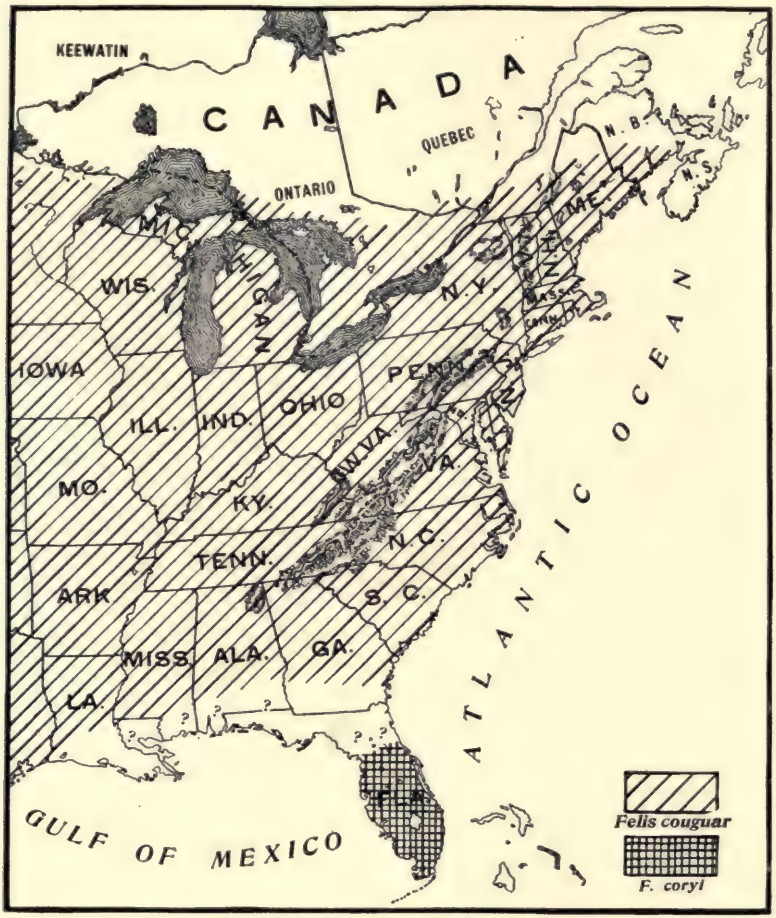
idently aware of our visit and suspicious of danger. The next morning, the tracks being quite fresh, he was run down and treed by the dogs in less than half an hour. This animal was a good-sized male and measured seven feet six inches from nose to tip of tail, and is the largest Panther I have killed in Florida, although the Indians claim they occasionally grow somewhat larger. I am inclined to believe, however, that Panthers rarely exceed eight feet in length in Florida, or anywhere else in the United States. A full grown male Florida Panther will

Young Florida Panther.

weigh from 125 to 150 pounds, but I have seen adult females of that form which were slightly less than six feet in length and weighed about 80 pounds. The western form averages larger, males 160 to 170 pounds in weight being not uncommon. In a series of specimens from Colorado recorded by Colonel Theodore Roosevelt* the lengths of three males are given as 7 feet 6 inches, 7 feet 8 inches and 8 feet, the latter being an unusually large animal which weighed 227 pounds.

The question as to how far a Panther can spring at a single leap has often been discussed. On one occasion a female chased by hounds was seen by one of my men to leap across a creek which was afterward measured and the width from bank to bank was found to be 25 feet. This seemed to me to be a very good leap at the time, but it is insignificant when compared with those described by Dr. Merriam, who says, "On one occasion Mr. Sheppard measured a leap, over snow, of nearly

* Outdoor Pastimes of an American Hunter, 1908, p. 31.



Map illustrating the probable former distribution of Cougars or Panthers in eastern United States. At the present time *F. couguar* is rare, having been exterminated nearly throughout its former range. *F. c. coryi* is still not uncommon in the wilder portions of Florida.

Felis couguar KERR. Type locality — Pennsylvania. Description as previously given.

Felis c. coryi (BANGS). (Proc. Biol. Soc. Wash., XIII, 1899, p. 15.) New name for *Felis concolor floridana* CORY (preoccupied) described in "Hunting and Fishing in Florida," 1896, p. 109. Type locality — Southeast of Lake Okeechobee, west of Hillsboro River, Dade Co., Florida. (Type No. 1155, Field Mus. Nat. Hist.) Color ferrugineous brown; legs long; feet small; nasals large.

Felis c. arundivaga (HOLLISTER).* (Proc. Biol. Soc. Wash., XXIV., 1911, p. 176.) Type locality — Twelve miles southwest of Vidalia, Concordia Parish, Louisiana. General color of upper parts grayish fawn-color, not rusty or red brown as in *coryi*, or paler and uniformly colored as in *azteca;* cranial characters approaching *coryi*.

* Described after cut of map was made.

forty feet. In this instance there were three preliminary springs, and the Panther struck his deer on the fourth. The longest leap measured by Mr. Sheppard was one of sixty feet, but here the Panther jumped from a ledge of rock about twenty feet above the level upon which the deer was standing. He struck it with such force as to knock it nearly a rod further off." (*l. c.*, pp. 31–32.)

In spite of the hair-raising stories of the ferocity of these animals, I am satisfied that Panthers are very much afraid of man and, judging from my experience, unless badly wounded, will rarely or never attempt to attack him. Colonel Theodore Roosevelt says,* "There are many contradictions in its character. Like the American Wolf it is certainly very much afraid of man; yet it habitually follows the trail of the hunter or solitary traveller, dogging his footsteps, itself always unseen. I have had this happen to me personally. When hungry it will seize and carry off any dog; yet it will sometimes go up a tree when pursued even by a single small dog wholly unable to do it the least harm. It is small wonder that the average frontier settler should grow to regard, almost with superstition, the great furtive cat which he never sees but of whose presence he is ever aware."

The time of breeding seems to be somewhat irregular; the period of gestation is about 90 days, but in Florida I have seen young less than three months old in December, and they are often found mating in February and early in March. The young are usually two in number, sometimes one and rarely three or four. The young Florida Panther is tawny brown in color, marked with numerous, large, irregular, brownish black spots; those of the northern form are lighter in color but the spotting is about the same. The cry of the cub resembles the screech of a parrot, but it often utters a soft whistle.

We often read of the "scream of a panther," but I have never heard what I could be certain was the cry of an adult animal of this species. Several of my Indian friends inform me, however, that they do "scream" and also occasionally yowl like a House Cat, but much louder. Hollister describes the cry of the Louisiana Panther as "a long drawn out, shrill trill, weird and startling. It commences low on the scale, gradually ascends, increasing in volume, and then lowers at the end."†

Genus **LYNX** Kerr.

Lynx Kerr, Anim. Kingd., I, 1792, p. 155. Type *Lynx vulgaris* Kerr.

Cranial characters as in *Felis;* tail short; ears tufted; body more or less spotted; only two premolars in each side of upper jaw, instead

* Outdoor Pastimes of an American Hunter, 1908, p. 22.

† Proc. Biol. Soc. Wash., XXIV, 1911, p. 177.

of three as in *Felis*; claws completely retractile; other characters as given for the family.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{2-2}{2-2}$, M. $\frac{1-1}{1-1}=28$.

Subgenus **LYNX** Kerr.

Lynx canadensis KERR.

CANADA LYNX. LUCIVEE.

Lynx canadensis KERR, Anim. Kingd., I, 1792, p. 157. MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 38 (Indiana). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 201 (Tennessee). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 25 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 543 (Indiana).

Lyncus borealis LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).

Lynx borealis KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 579 (Cook Co., Illinois).

Type locality — Eastern Canada.

Distribution — Practically the whole of northern North America, from the northern border of United States northward, farther south in the Rocky Mountains, in New York and in the mountains in Pennsylvania; formerly its range extended as far south as Illinois and Indiana. Replaced in Alaska and New Foundland by allied forms.

Description — General color light gray, more or less grizzled with brown; belly grayish white; throat grayish white; ear tufts brownish black, usually more than 1.50 inches long; a ruff of long hairs on sides of head, grayish white, the middle hairs with ends brownish black and forming a black patch in middle of the ruff; end of tail wholly black; feet large.

Measurements — Total length, about 38 in. (965 mm.); tail vertebræ, 4 in. (102 mm.); hind foot, 9.75 in. (248 mm.).

The Canada Lynx is now a comparatively rare animal within our limits and the few that remain are confined to northern Wisconsin, although in early days its range extended considerably further south. There is always more or less likelihood of the untrained observer confounding the Wild Cat (*L. ruffus*) with this animal, and many records are untrustworthy for that reason; but there are numerous well authenticated instances of its occurrence in Indiana (see Hahn, *l. c.*, p. 544); and Kennicott includes it in his list of mammals of Cook Co., Illinois (*l. c.*, p. 579). I have seen specimens (skins or skulls) from Douglas

Canada Lynx (*Lynx canadensis*).

and Iron counties, Wisconsin; and Jackson records it from Ashland, Bayfield, Iron, Oneida and Price counties (*l. c.*, 1908, p. 25). The following gentlemen are my authorities for the statement that the species still exists in a number of counties in northern Wisconsin: Door Co. (John Weber, Forestville); Marinette Co. (George A. Williams, Kremlin); Florence Co. (J. E. Parry, Florence); Taylor Co. (J. W. Benn, Medford); Iron Co. (James Miller, Cedar); Price Co. (W. J. Webster, Park Falls); Marathon Co. (George F. Erzwein, Athens); Douglas Co. (N. Lucins, Jr., Solon Springs); Douglas Co. (George W. Zeon, Foxboro).

Mr. Edward G. Kingsford of Iron Mountain, Michigan, who is well acquainted with this animal, writes: "There are quite a number of Canada Lynx (Big-footed Lynx) in this country now. They seem to be on the increase since the passing of the old trappers. It is quite a common thing to see their tracks in the big woods. This is the only thing that I know of that could have been mistaken for a Panther, an animal I have never seen or heard of in this part of the country." Old trappers claim that it was common throughout northern Michigan in early days.*

The Canada Lynx preys largely upon small mammals, such as Mice, Gophers, Squirrels, Rabbits and Hares, especially the last, but it also kills large game, and it destroys many birds, such as grouse and ducks, especially during the breeding season. Hunters inform me that they occasionally kill Foxes and Porcupines, but they probably seldom attack the latter unless forced to do so by lack of other food. Audubon and Bachman† say: "At a public house in Canada we were shown the skin of one of these Lynxes, the animal having been found quite helpless and nearly dead in the woods. It appears that leaping onto a Porcupine, it had caught a tarter, as its head was greatly inflamed and it was nearly blind. Its mouth was full of sharp quills of that well defended animal, which would in a day or two have occasioned its death."

Mr. R. MacFarlane says,‡ "It feeds on eggs, ducks, partridges, mice, stranded fish, and occasionally on land captured beaver, young deer or sheep, while rabbits, of course, form their staple article of diet. It is chiefly taken in snares; some are trapped, and others are followed up with dogs, treed, and shot. The flesh is white and tender, and is an important and much-relished native country product. The female is

* N. A. Wood says, "While trapping on Sand Point in 1855–6, Mr. Fittenger took fifteen individuals of this species, He was apparently very sure of the identity of the form, distinguishing it from the Wild Cat by the long ear tufts (Mich. Geol. & Biol. Surv. Pub. for 1911, p. 311).

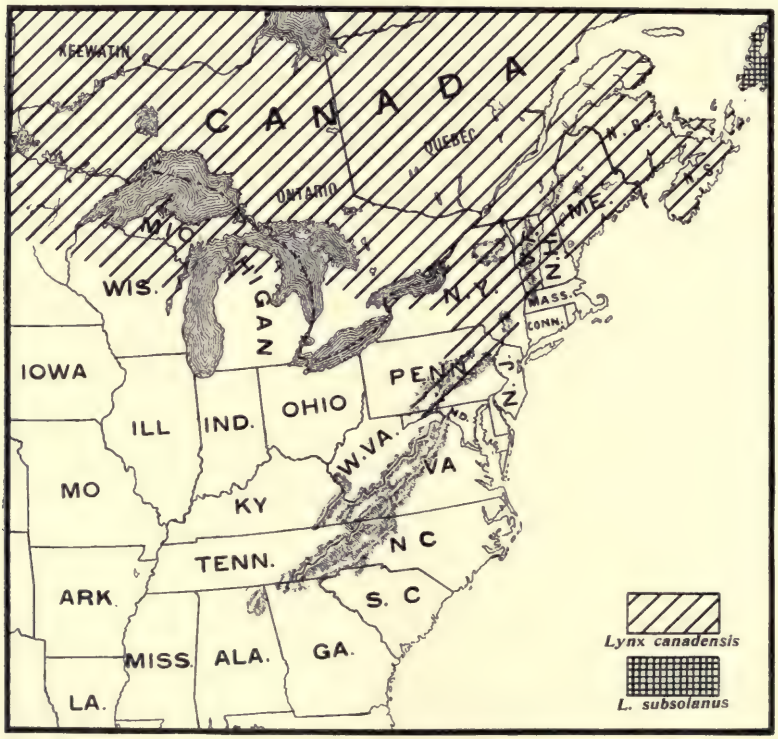
† Quadrupeds of N. Amer., I, 1846, p. 138.

‡ Proc. U. S. Nat. Mus., XXVIII, 1905, p. 692.

said to bring forth from two to five, and not infrequently as many as six, at a birth annually in June and July, the period of gestation being about three months. The young are about the size of a puppy, with eyes partly open, but are very helpless for several days. They are suckled for about two months."

It is claimed that full-grown Deer are occasionally killed by these animals. Numerous instances are cited by Mr. E. T. Seton,* as well as several of the older writers, including Audubon and Bachman. Mr. S. N. Rhoads states,† "They will not hesitate to fasten themselves on the necks of deer, trusting to bring them down by sheer exhaustion and blood letting before the deer can manage to drag them off by running through brush or branches of thick trees, or by jumping in the water."

It is extremely doubtful if a Canada Lynx will ever attack man unless wounded or cornered so that it cannot escape, but I can say



Map illustrating approximate range of the Canada Lynx (*Lynx canadensis*) in eastern United States and Canada. Its range formerly extended as far south as Illinois and Indiana.

* Life Histories of Northern Animals, II, 1909, pp. 692–693.

† Mamm. of Penn., 1903, p. 140.

nothing regarding this from personal experience, having killed but two of these animals, one in a tree and another which had been caught in a trap.

The fur has a high commercial value and the skins are much used by trappers and hunters, as they make exceedingly warm, soft robes.

Specimens examined from Wisconsin and adjoining states:

Wisconsin — (O. C.) Gordon, Douglas Co. (skull), 1; Mercer, Iron Co. (skull), 1; Fisher Lake, Iron Co. (skull), 1.

Ontario, Canada, 1.

Subgenus **EUCERVARIA** Palmer.

Lynx ruffus (GÜLDENSTAEDT).

WILD CAT. BAY LYNX. BOB CAT.

Felis ruffa GÜLDENSTAEDT, Nov. Comm. Acad. Scient. Imp. Petrop., XX, 1775 (1776), p. 484.

Lyncus rufus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).

Lynx rufus KENNICOTT, Trans. Ill. State Agr. Soc., 1853–54 (1855), p. 579 (Cook Co., (Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 653 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 181 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). TYRRALL, Mamm. of Canada, Toronto, 1888, p. 9 (Ontario). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 7 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 138 (Indiana). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 3 (Kentucky). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 201 (Tennessee). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 123 (Wisconsin).

Lynx ruffus ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 25 (Wisconsin). *Ib.*, VII, 1910, p. 89 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 240 (Indiana).

Type locality — New York.

Distribution — In eastern North America, from southern Canada to the Gulf states; replaced in Nova Scotia, Florida and the West by allied forms.

Description — General color pale rufous brown, more or less tinged with grayish; legs and head showing more or less dark spots or streaks; end of tail black above, white below; a streak of dark brown mixed with black extends down the middle of the back; upper neck tinged with darker rufous brown; throat with *distinct brownish collar;* belly white, with blackish streaks or spots; feet comparatively small; ear tufts blackish, usually about 1 in. or less in length.

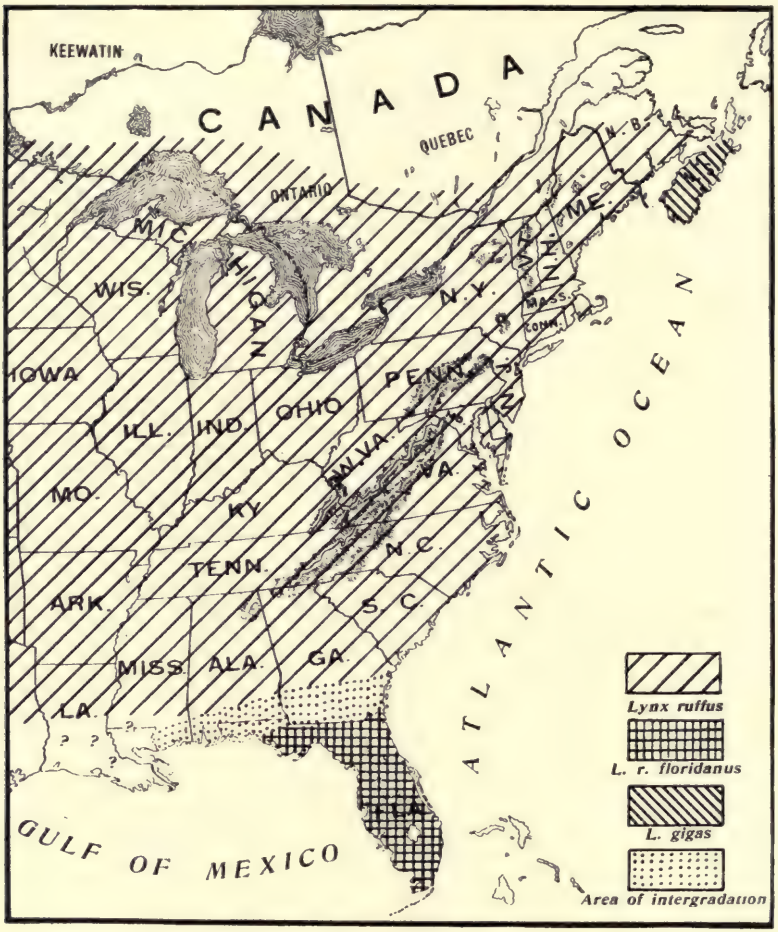
Measurements — Total length, about 36 in. (914 mm.); tail vertebræ, 6.50 in. (165 mm.); hind foot, 7 in. (178 mm.).

Wild Cat or Bay Lynx (*Lynx rufus*).

The Wild Cat or Bay Lynx was formerly numerous throughout Illinois and Wisconsin, but at the present time they have disappeared from the more settled portions of the country. They are still found in more or less numbers in extreme southern Illinois and are common in northern Wisconsin; specimens are also occasionally taken in isolated localities throughout both states. Records of its capture are too numerous to give in detail, as a few are killed every year in most of the northern counties of Wisconsin; farther south it becomes rather rare, although I have authentic records of its occurrence in Buffalo and Vernon counties and also in Fond du Lac County, Mr. C. E. Brown of Hamilton having killed one on June 15, 1907. Mr. W. E. Snyder of Beaver Dam has six specimens in his collection, killed in Ashland County, Wisconsin, in 1907 and 1908; and Mr. F. E. Munroe of Lady Smith, Rusk Co., informs me that in the fall and winter one or more are killed nearly every week. It is common in the Michigan peninsular. Mr. Edward G. Kingsford of Iron Mountain writes me that it is plentiful in that part of the country.

In extreme northern Illinois and southern Wisconsin at the present time it occurs only as a rare straggler. There is a specimen in the Hoy collection preserved in the Carnegie Public Library at Racine, Wisconsin, which was taken in Racine County at an early date. Jackson states that an adult male was trapped at Hawleys Lake six miles west of Cable, August 23, 1908, and another was taken in the same locality, December 21, 1908 (*l. c.*, 1910, p. 89). Snyder records one killed in Dodge County, near Alderly, in 1898 (*l. c.*, p. 123). It has been lately reported from Jo Daviess Co., Illinois, and Kennicott records it from Cook Co. (*l. c.*, p. 579), although none has been observed in this vicinity for many years. There is a specimen in the Northwestern University collection at Evanston, taken near Rock Island, Illinois, some years ago. In extreme southern Illinois I have trustworthy information that it still occurs in more or less numbers in Galletin, Pope, Alexander, Jackson and Randolph counties. Mr. J. C. Baker of Golconda, Pope Co., informs me that two Wild Cats were killed in that vicinity in the winter of 1907.

The habits of the Wild Cat, Bob Cat, or Bay Lynx, as it is variously called, are not very different from those of the Canada Lynx. It contents itself with smaller game, however, than its more powerful relative and would never think of attacking a full grown Deer, although Indians in Florida tell me that it does occasionally kill young fawns. It subsists largely upon Rodents of various kinds, varied with birds and eggs and occasionally fish when it can find them, but Rabbits furnish its main supply of food. Wild Cats are very fond of poultry. I have



Map illustrating approximate geographical distribution of Wild Cats or Bay Lynxes in eastern North America.

Lynx ruffus (GÜLDEN.). Type locality — New York. Description as previously given.

Lynx r. floridanus (RAFINESQUE). (Amer. Month. Mag., II, 1817, p. 46.) Type locality — Florida. Darker than *ruffus*, with stronger markings and legs comparatively longer.

Lynx gigas BANGS. (Proc. Biol. Soc. Wash., XI, 1897, p. 50.) Type locality — 15 miles from Bear River, Nova Scotia. Decidedly larger, darker and blacker above than *ruffus;* canine teeth longer.

trapped many of them by placing a live hen in a box frame covered with wire netting and setting steel traps on opposite sides. In running around the cage trying to find an entrance, the animal is almost certain to be caught in one of the traps; but they are very suspicious of a bait over a steel trap and are not nearly so likely to be taken as by the method above described. The best and probably the only satisfactory way to hunt them is with dogs. Almost any dog will trail a Wild Cat, as the scent seems to be very strong. In fact in the South, where they are numerous, they are a nuisance when one is hunting Panthers or Bear, as the hounds will often leave the trail of these animals and follow the later made track of a Wild Cat. When chased by hounds Wild Cats will very often run in a circle, going over the same trail again and again unless pressed too closely by the dogs. Sometimes, however, they will take to a tree at once, or again run straight for a long distance before doing so. Usually a full grown Wild Cat is more than a match for any dog, but one of my powerful bear dogs once caught a large one on the ground and killed it alone, although he was rather badly scratched in the encounter. Unlike many animals, unless taken very young they never become tame in captivity. Several which I have kept for more than a year were as vicious as when first taken, and always snarled and growled savagely whenever I approached the cage.

The young are born in some sort of a den, often a hollow tree or log, and number from two to four. The flesh is palatable and far better, in my opinion, than that of Raccoon or Opossum. This statement has the support of Dr. C. Hart Merriam who says,* "I have eaten the flesh of the Wild Cat, and can pronounce it excellent. It is white and very tender, and suggests veal more than any other meat with which I am familiar."

Specimens examined from Illinois, Wisconsin and adjoining states: Wisconsin — (O. C.) Bayfield Co. (skull), 1; Gordon, Douglas Co. (skull), 1; Langlade Co. (adults), 3; (S. C.) Ashland Co. (skulls), 6 = 11. Illinois — Rock Island Co., 1. (In Northwestern University collection.) Minnesota — Aitken, 1.

* Mamm. Adirondack Reg., 1886, p. 41.

Family CANIDÆ. Wolves, Foxes, Dogs, etc.

This family comprises the dog-like animals, including the Wolves, Foxes, Jackalls, etc.; and is practically cosmopolitan, representatives being found in all the continents and many of the larger islands except New Zealand and, perhaps, Australia, as there is some doubt as to whether the Wild Dog of the latter country is the descendant of an indigenous or an introduced species. Unlike the Cats, the claws of these animals are not retractile, sharp, or curved, and are of little use to them in capturing prey, their only weapons of offense being their powerful jaws and teeth. In the *Canidæ* a cæcum is always present and, while in some species it is short and simple, in others it is of fair size and is often more or less coiled and twisted; that of an average size dog, when uncoiled, is usually about 5 or 6 inches in length. Other characters for this family are, inflated but only partially divided audital bullæ, the septum being incomplete; alisphenoid canal present; four premolars on each side of both jaws and upper carnassial with two cusps.

Prof. Huxley divided the numerous species belonging to this family in two series: The *Lupine* or wolf-like forms, and the *Vulpine*, consisting of the Foxes and their allies. The latter hunt in a stealthy manner and generally prey upon animals smaller than themselves. The *Lupine* forms, on the contrary, are larger, bolder and more powerful, and when gathered together in packs will pursue and kill large animals, such as Buffalo, Elk and Deer, and when pressed by hunger will even attack man.

In Russia and other parts of northern Europe, Wolves are greatly feared by the peasants in sparsely settled districts, and much has been written by ancient writers, such as Pliny, Aristotle, Topsell and others, regarding their ferocity and cunning, who vied with each other in lauding the sagacity displayed by these animals, in many instances being apparently unable to separate truth from fiction. Writing in 1607, Edward Topsell says,* "It is also worth the observation how he

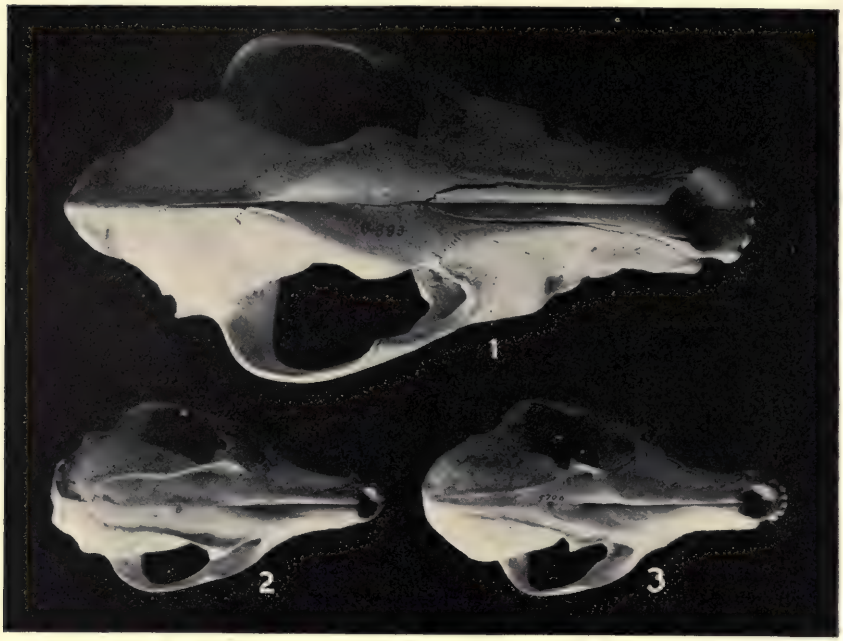
As described by Topsell.

* Historie of Foure Footed Beastes, London, 1607, p. 739.

draweth unto him a Calfe that wandereth from the dam; for by singular treacherie he taketh him by the nose, first drawing him forwarde, and then the poore beast striveth and draweth backward, and thus they struggle together, one pulling one way, and the other another, till at last the Wolfe perceiving advantage, and feeling when the Calfe pulleth heavyest, suddenly he letteth go his hold, whereby the poore beast falleth back upon his buttocks, and so doune right upon his backe; then flyeth the Wolfe to his belly which is then his upperpart, and easily teareth out his bowels, so satisfieng his hunger-greedy appetite; But if they chance to see a Beast in the water, or in the marsh emcombred with mire, they come round about him, stopup al the passages where he shold come out, baying at him, and threatning him, so as the poore distressed Oxe plungeth himself many times over head and ears, or at the least wise they so vex him in the mire, that they never suffer him to come out alive. At last when they perceive him to be dead and cleane without life by suffocation, It is notable to observe their singular subtility to draw him out of the mire, whereby they may eat him; for one of them goeth in, and taketh the beast by the taile, who draweth with all the power he can, for wit without strength may better kill a live Beast, than remove a dead one out of the mire; therefore he looketh behind him and calleth for more helpe, then presently another of the Wolves taketh the first Wolves tail in his mouth, and the third Wolfe the seconds, a fourth the thirds, a fifth the fourths, and so forward, encreasing their strength, until they have pulled the beast out into the dry lande."

Domestic Dogs of the present day are members of this family and are claimed to be divisible into nearly two hundred so-called species or varieties. Their ancestry is veiled by the mist of ages, although it is probable that they are descendants of several wild species including Wolves and Jackals; but they have become so differentiated by admixture during the centuries they have existed in a non-feral condition that the characters of the original type or types have been lost. Beddard says, "There seems to be no doubt that the Dog was the 'friend of man' in very early times. Its remains have been met with in Danish kitchen-middens, in the lake-dwellings of the Swiss lakes, and during the Bronze Age in Europe generally. But 'there are few more vexed questions in the archæology of natural history than the origin of the Dog.' Its remains already referred to may in many cases have argued its use as food. But in a Neolithic barrow a Dog was found buried with a woman, the skeleton of both being *in situ;* this animal was about the size of a Shepherd Dog."*

* Mammalia, 1902, p. 422.



1, Skull of Gray Wolf (*Canis*); 2, skull of Gray Fox (*Urocyon*); 3, skull of Red Fox (*Vulpes*). (About ⅓ nat. size.)

KEY TO THE GENERA.

Group 1. Postorbital process of frontal bone rounded, with end curving downward; upper incisors with well-marked lobes or notches on sides; temporal crests joining and extending in a single parietal ridge or sagittal crest (low in the Prairie Wolves or Coyotes, but conspicuously high in the adults of the large Timber Wolves); a frontal sinus present.

Genus CANIS, Wolves, p. 313.

Group 2. Postorbital process of frontal bone *concave*, with its anterior outer edge turned slightly upward; some of the upper incisors very slightly lobate or notched or not at all; no frontal sinus present.

A. Temporal crests widely separated, at least .75 inch apart in adult; upper incisors not notched; long hairs of tail rather coarse, with central ridge of black hairs; posterior angle of under jaw abruptly emarginate below.

Genus UROCYON, Gray Foxes, p. 300.

B. Temporal crests much nearer together; some of the upper incisors very slightly notched; hairs on tail long and soft, mixed with soft fur; posterior portion of under jaw not abruptly emarginate below.

Genus VULPES, Red Foxes, p. 305.

KEY TO THE SPECIES.

(ADULTS.)

GROUP 1. Total length (nose to end of tail vertebræ) more than 43 inches; sides of neck not red brown or yellow brown; pupil of eye round.

Color variable, gray usually predominating; tail vertebræ more than 9 inches long; diameter of upper canine teeth at base .50 inch or more; width of nose pad more than 1.25 inches. GRAY WOLF OR TIMBER WOLF. *Canis nubilus*, p. 313.

Color similar to preceding species; tail vertebræ less than 9 inches long; diameter of upper canine teeth at base less than .50 inch, usually .4 inch or less; width of nose pad less than 1.25 inches. COYOTE OR PRAIRIE WOLF. *Canis latrans*, p. 322.

GROUP 2. Total length less than 43 inches; pupil of eye elliptical.

SECTION 1. Sides of neck red brown or reddish yellow.

PART 1. Back and sides of body red brown or reddish yellow; long hairs on tail mixed with soft under fur.

Feet and considerable portion of legs blackish; throat white; no distinct red brown band on chest. RED FOX. *Vulpes fulvus*, p. 305.

PART 2. Back and sides of body not red brown or reddish yellow; hair on tail rather coarse, not mixed with soft under fur.

Back grayish, the hair blended with black and grayish white; sides of neck red brown; a well marked *red brown band on chest;* total length usually less than 37 inches. Occurs within our limits in central and southern Illinois. GRAY FOX. *Urocyon cinereoargenteus*, p. 300.

Similar to last, but larger; rusty brown markings darker and more ferrugineous; total length usually 37 inches or more. Occurs within our limits in southern Wisconsin and perhaps in northern Illinois. WISCONSIN GRAY FOX. *Urocyon c. ocythous*, p. 303.

SECTION 2. Sides of neck not red brown or reddish yellow; long hairs of tail mixed with soft under fur.

General color black, hairs more or less tipped with white (Black Fox or Silver Fox); or general color more or less fulvous and gray, but with a black stripe across the shoulders and another down middle of the back (Cross Fox). These are color phases of the Red Fox (*Vulpes fulvus*) known as BLACK FOX, SILVER FOX, and CROSS FOX.

KEY TO THE SPECIES.

(YOUNG.)

The following characters by which the young (pups) of the various species may be recognized are given by Mr. Vernon Bailey (Circular No. 69, Bureau of Biological Survey, 1909, p. 2):

"Muzzle blackish at birth, fading in a month or 6 weeks to grayish. Head grayish, in decided contrast to black of back, nose and ears. Ears black at tips, fading to grayish in a month or 6 weeks. Tail black, fading to gray with black tip."

GRAY WOLF OR TIMBER WOLF. *Canis nubilus*, p. 313.

"Muzzle tawny, or yellowish brown, becoming more yellowish with age. Head yellowish gray, not strongly contrasted with rest of body. Ears dark brown at tips and back, soon fading to yellowish brown. Tail black, fading to gray with black tip." COYOTE OR PRAIRIE WOLF. *Canis latrans*, p. 322.

"Muzzle blackish. Head grayish, face back of eyes sharply pepper and salt gray. Ears large, back of ears dusky at tip, fulvous at base. Tail with tip black at all ages." GRAY FOX. *Urocyon cinereoargenteus*, p. 300.

"Muzzle blackish. Head dusky with sides of face light yellowish. Ears large, nearly the whole back of ears bright black at all ages. Tail dusky, tip white at all ages." RED FOX. *Vulpes fulvus*, p. 305.

Genus **UROCYON** Baird.

Urocyon Baird, Mammals N. Amer., 1857, p. 121. Type *Canis virginianus* Erxleben.

Upper view of skull. (Much reduced.)

Temporal crests widely separated; posterior angle of lower jaw abruptly emarginate below; upper incisors not distinctly notched; lower sectorial tooth with supplementary tubercle; postorbital process of frontal bone concave, with its anterior outer edge turned slightly upward; no frontal sinus present; tail with central ridge of coarse black hairs.

Dental formula:

$$\text{I.}\ \frac{3-3}{3-3},\ \text{C.}\ \frac{1-1}{1-1},\ \text{Pm.}\ \frac{4-4}{4-4},\ \text{M.}\ \frac{2-2}{3-3}=42.$$

Urocyon cinereoargenteus (SCHREBER).

GRAY FOX.

Canis cinereoargenteus SCHREBER, Säughthiere III, 1775, pl. XCII.
Vulpes (*Urocyon*) *virginianus* BAIRD, Mammals N. Amer., 1857, p. 143 (Illinois).
Urocyon cinereoargenteus EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 138 (Indiana). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 548 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 32 (Illinois). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 572.

Type locality — Eastern North America.

Distribution — New York and New Jersey to Georgia, west to the Mississippi Valley and north at least to north-central Illinois; exact limits of range not definitely determined.

Description — *Adult:* General color of back and sides grayish, the hairs being banded with black and grayish white; sides of the neck and a *band across the chest red brown;* ears, inner surface of legs, sides of belly and under surface of tail also more or less red brown, the

extent and intensity of the color variable; throat and greater portion of belly whitish; sides of nose and under jaw blackish; a ridge of black hairs extends down middle of upper surface of tail.

Young pups have the muzzle blackish; the head grayish; the back of the ears fulvous at the base and dusky at the tip; tail with black tip.

Measurements — Total length, about 35.50 in. (900 mm.); tail vertebræ, about 11.50 in. (282 mm.); hind foot, 5.25 in. (133 mm.).

The Gray Fox was formerly not uncommon in parts of Illinois, but of late years it seems to have become scarce in most localities except in the extreme southern portion of the state. In spite of repeated attempts to obtain specimens, I have been able to secure but one, a fine male from Petersburg, Menard Co. Mr. S. J. Miller of Millersville informs me they are occasionally killed in Christian County; they are reported to occur in more or less numbers in Hardin County by Mr. N. J. Aydlott of Rosiclare, and in Alexander County by Messrs. W. L. Conrad and Wm. Rabb of Olive Branch. Mr. John Johnson writes me it is found in the vicinity of Wolf Lake, Union Co. Mr. Howell states they were reported from Lick Creek, Union Co. (*l. c.*, p. 32). Kennicott states that Gray Foxes were formerly not uncommon in Cook County,* but I have been unable to learn of their present occurrence in northern Illinois except in the extreme northern counties where Gray Foxes are reported as being occasionally taken. I have reliable information that several have been killed in Jo Daviess County, but have not seen specimens from that locality and it is probable they may prove to be the Wisconsin Gray Fox, *U. c. ocythous*.

The Gray Fox prefers a wooded country away from settlements and upon the advent of civilization its numbers rapidly decrease. Its fondness for poultry doubtless equals that of the Red Fox, but it is seemingly less cunning, as it is more easily trapped or killed. In many parts of the South it makes its den in hollow trees or logs, more than in burrows in the ground; but in Illinois and Indiana, from what I have been able to learn, the majority live in burrows. Hahn says, in Indiana "the dens do not differ from those of the red fox but they are never placed out in the open fields as are those of the latter species." (*l. c.*, p. 550.) The young are born in March or early April, the number usually varying from 4 to 6. They are practically omnivorous: their principal food consists of various species of Rodents, (Mice, Rats, Rabbits, etc.), but they also eat birds, eggs, some berries and occasionally dead fish, reptiles and insects. When chased by dogs they often seek refuge in low branched trees. I once shot a Gray Fox in a low pine tree where it had climbed among the branches about seven feet

* Trans Ill. State Agr. Soc., I, 1853–54 (1855), p. 578.

Gray Fox (*Urocyon cinereoargenteus*).

from the ground. Audubon and Bachman say,* "We were unable to obtain any information in regard to the manner in which the Fox climbs trees, as he does not possess the retractile nails of the cat or the sharp claws of the squirrel, until we saw the animal in the act. At one time when we thus observed the fox, he first leaped on a low branch four or five feet from the ground, from whence he made his way upward by leaping cautiously and rather awkwardly from branch to branch, till he attained a secure position in the largest fork of a tree, where he stopped. On another occasion, he ascended in a manner of a bear, but with far greater celerity, by clasping the stem of a small pine. We have since been informed that the Fox also climbs trees occasionally by the aid of his claws, in the manner of a raccoon or a cat. During winter only about one fifth of the Foxes chased by hounds will take to a tree before they suffer themselves to be run down; but in summer, either from the warmth of the weather, causing them to be soon fatigued, or from the greater number being young animals, they seldom continue on foot beyond thirty or forty minutes before they fly for protection to a tree."

Specimens examined from Illinois:

Illinois — Petersburg, Menard Co., 1; (N. M.) Mt. Carmel, 1 = 2.

Urocyon cinereoargenteus ocythous BANGS.

WISCONSIN GRAY FOX.

Urocyon cinereoargenteus ocythous BANGS, Proc. New Eng. Zoöl. Club, I, 1899, p. 43. JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 26 (Wisconsin). *Ib*, VIII, 1910, p. 89 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 140 (Wisconsin).

Vulpes virginianus LAPHAM, Trans. Wis. Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). ?KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook County, Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). ?ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 182 (Iowa).

Type locality — Platteville, Grant County, Wisconsin.

Distribution — Upper Mississippi Valley; exact limits of range not satisfactorily determined.

Description — Similar to *U. cinereoargenteus*, but larger; tail longer and hind foot larger; the back and sides less gray, showing a yellowish tinge; the red brown on various parts of body more ferrugineous.

Measurements — Total length, ♀, 40.30 in. (1024 mm.); tail vertebræ, 15.25 in. (386 mm.); hind foot, 5.35 in. (136 mm.). Measurements in millimeters as given by Bangs: Total length, ♂, 39.50 in. (1005 mm.); tail vetebræ, 14.50 in. (365 mm.); hind foot, 5.70 inches (145 mm.).

* Quadrupeds of N. Amer., I, 1846, p. 167.

The range of the Wisconsin Gray Fox is not definitely known, but it probably occurs throughout the greater portion of Wisconsin and also in northern Illinois. Kennicott states that Gray Foxes were formerly not uncommon in Cook Co., Illinois (*l. c.*, p. 578), which may or may not have been this form. I have seen no specimens from this

Map showing the type localities of races of Gray Foxes in eastern United States. The range limits of the various forms have not been satisfactorily determined.

Urocyon cinereoargenteus (SCHREBER). Type locality — Eastern North America, probably Carolina or Virginia. Description as previously given.

Urocyon c. ocythous BANGS. Type locality — Platteville, Grant County, Wisconsin. Description as previously given.

Urocyon c. floridanus RHOADS. (Proc. Acad. Nat. Sci. Phila., 1895, p. 42.) Type locality — Tarpon Springs, Hillsboro County, Florida. Smaller than *cinereoargenteus;* breast paler, but without white under parts.

Urocyon c. borealis MERRIAM. (Proc. Biol. Soc. Wash., XVI, 1903, p. 74.) Type locality — Marlboro, near Monadnock, New Hampshire. "Similar to *cinereoargenteus*, but decidedly larger, with marked skull and tooth differences." (Merriam).

locality, but it would be expected to intergrade with *U. cinereoargenteus* in northern Illinois. The type was taken in Grant County, Wisconsin, and Hollister records two specimens which he collected at Delavan, Walworth Co. (*l. c.*, p. 140). Jackson records it from Dunn County, (*l. c.*, 1908, p. 26); he also states there is a specimen in the University of Wisconsin collection at Madison taken in Lema Township, Pepin Co., in 1907 and scalps from Jackson, Dunn and Adams counties (*l. c.*, 1910, p. 89). There is a specimen in the Milwaukee Public Museum from Prescott, Pierce Co., and hunters have reported Gray Foxes from Jefferson County. Gray Foxes are reported from Jo Daviess Co., Illinois, but I have seen no specimens from that locality. The habits of this northern race probably do not differ from those of the Gray Fox.

Specimens examined from Wisconsin:

Wisconsin — (B. S.) Delavan, Walworth Co., 1; (M. P. M.) Prescott, Pierce Co., 1 = 2.

Genus **VULPES** Brisson.

Vulpes Brisson, Regn. Anim., 2nd ed., 1762, p. 173. Type *Canis vulpes* Linnæus.

Nasal bones not extending back of maxillaries; temporal crests not widely separated as in *Urocyon;* frontal sinus absent; posterior portion of under jaw not abruptly emarginate; upper incisors not noticeably lobed; postorbital process of frontal bone concave above, the anterior outer edge turned slightly upward; nose elongated and tapering; tail soft, long and bushy; pupil of eye elliptical.

Upper view of skull. (Much reduced.)

Dental formula:

$$\text{I.}\ \frac{3-3}{3-3},\ \text{C.}\ \frac{1-1}{1-1},\ \text{Pm.}\ \frac{4-4}{4-4},\ \text{M.}\ \frac{2-2}{3-3}=42.$$

Vulpes fulvus (DESMAREST).

RED FOX.

BLACK FOX, SILVER FOX, CROSS FOX (color phases of the Red Fox).

Canis fulvus DESMAREST, Mammalogie, I, 1820, p. 203.

Vulpes fulvus LAPHAM, Trans, Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook County, Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 138 (Indiana).

Snyder, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin). Jackson, Proc. Biol. Soc. Wash., XX, 1907, p. 74 (S. W. Missouri). *Ib.*, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 26 (Wisconsin). Hollister, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 140 (Wisconsin). Hahn, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 552 (Indiana). Howell, Proc. Biol. Soc. Wash., XXIII, 1910, p. 32 (Illinois and Kentucky).

Vulpes vulgaris Allen, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 182 (Iowa). Herrick, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 80 (Minnesota).

Vulpes fulva Wood, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 571 (Illinois).

Vulpes fulvus argentatus Snyder, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin).

Type locality — Virginia.

Distribution — North America, from Hudson Bay to northern Georgia, west to Nebraska and in the Northwest to the Saskatchewan region; replaced in Nova Scotia, Newfoundland and the West by allied forms.

Description — Adult: General color of upper parts yellowish brown, the middle reddish brown; throat, middle of belly and under sides of legs white or whitish, often more or less tinged with dusky; front of legs and feet largely brownish black; terminal half of upper surface of ears dark brown; tail yellowish brown, the hairs more or less tipped with brownish black; end of tail white.

Young pups have the muzzle blackish; head dusky, with sides of face light yellowish and nearly the whole of the back of ears black; tail dusky with the tip white.

Measurements — Total length, about 38 in. (965 mm.); tail vertebræ, 14.50 in. (386 mm.); hind foot, 5.75 in. (146.4 mm.).

Remarks — The so-called Black or Silver Fox and Cross Fox are color phases of the Red Fox. In the Black or Silver phase the general color is black, the hairs being largely tipped with white. The Cross Fox has a black streak across the shoulders and another down the middle of the back, the body color being variable but showing more or less gray and fulvous. These variations in pelage were at one time considered to represent different species and were given specific names.*

The Red Fox occurs in more or less numbers throughout Illinois and Wisconsin, wherever the country is not too thickly settled. It is common in most parts of the interior of both states and I have examined specimens from Bayfield, Ashland, Iron, Langlade, Oconto and Dunn counties in northern Wisconsin, and one from Alexander Co., southern Illinois. Howell records it from Union County (*l. c.*, 1910, p. 32), and a number of hunters with whom I have corresponded inform me it is common in most of the southern counties.

* Silver Fox, *Vulpes argentatus*; Cross, Fox, *Vulpes decussatus*.

Red Fox (*Vulpes fulvus*).

The Red Fox has justly acquired a reputation for shrewdness and cunning and an ability to avoid traps and generally take care of himself not exceeded by any of our mammals, as anyone who is well acquainted with him can testify.

For many years the writer had a somewhat unusual opportunity for observing these animals at his country estate at Great Island, Massachusetts, where, as no dogs were allowed in the Deer Park, a thickly wooded enclosure of some 175 acres, it was considered a most desirable residence by Foxes, especially as there was a good supply of Hares, Rabbits, quail and pheasants to be found there. We knew of several dens which seemed to be always occupied. Young Foxes were seen playing about them each spring and we often heard them barking in the evening. One of these dens was under a huge split boulder in open ground on a sandy peninsular covered with coarse beach grass at least half a mile from trees; the others were burrows in the ground in the deep woods. Their numbers apparently increased rapidly, as did also the mortality among the pheasants and Hares, and it was therefore decided to exterminate them. As no attempt had been made to shoot them, they had become quite bold and were often seen trotting leisurely through the woods or standing watching us from a distance, but after two or three were shot, the others became very shy. During the winter the man in charge of the place kept a dozen or more traps constantly baited, with the result that some twenty Skunks and other mammals were caught, but no Foxes. During the next few years, while several were shot and a few trapped, their numbers did not seem to decrease materially and all efforts to exterminate them by shooting or trapping proved unavailing.*

The Red Fox makes its home in burrows in the ground and at times in holes in rocks or ledges, or hollow stumps, and the young, which generally number from 4 to 8, are born late in March or early in April. It is both nocturnal and diurnal in its habits and is practically omnivorous. Its well-known fondness for poultry is too proverbial to require comment, and it preys upon Muskrats, Rabbits, Skunks, Mice, Rats, birds' eggs, etc., etc., as well as fish; and it is said to eat grapes and other fruit.

Regarding their depredations in the poultry yard, Stone and Cram say,† "I have known a fox to kill three or four full grown fowls in an

* This was undertaken as an experiment to learn if Foxes could be exterminated or driven away from a place, which they liked, by non-scientific means, such as would be employed by the average farmer, including shooting with rifle or shot-gun and trapping with various kinds of traps using both live and dead bait, including Mice, chickens, Rabbits, etc., but the use of hounds, poison and prepared scents being barred. The area in question consisted of woodland connected with the mainland by a treeless, sandy peninsular some two miles in length.

† American Animals, 1902, pp. 266–267.

Cross Fox. Red Fox. Silver Fox.

Color phases of the Red Fox (*Vulpes fulvus*).

orchard close to a farm house where the family were at breakfast, and yet get away without being seen, carrying one of his victims with him. On another occasion, quite recently, one of my neighbors had thirty pullets taken in a single night. Eighteen of them were found next morning in a heap at the foot of an oak tree. Another farmer tells me that he has lost one hundred and fifty in one season, all presumably going to the foxes.

"Yet although the farmer and the fox are such inveterate enemies, they manage to benefit each other in a great many ways quite unintentionally.

"The fox destroys numberless field mice and woodchucks for the farmer, and in return the farmer supplies him with poultry, and builds convenient bridges over streams and wet places, which the fox crosses oftener than the farmer, for he is as sensitive as a cat about getting his feet wet.

"On the whole I am inclined to believe that the fox gets the best part of the exchange, for, while the farmer shoots at him on every occasion, and hunts him with dogs in the winter, he has cleared the land of wolves and panthers, so that foxes are probably safer than before any land was ploughed.

"When the snow is deep the farmer's sled makes the best of paths for the fox, who appropriates them for his own use just as unconcernedly as he does the regular highway. But to see a fox get round the farmer's dogs, in order to make friends with them, is one of the most astonishing revelations of character. Usually the dogs seem hardly to know at first what to make of his advances, but the fox is pretty certain to succeed in bringing them to his side in the end, and after that they may be seen playing together day after day.

"If, as I am tempted to believe, the fox really works this scheme with the deliberate purpose of making it safer for him to get at the farmer's chickens, he is gifted with a degree of shrewdness beyond anything he has been credited with."

Some persons are able to imitate the squeak of a Meadow Mouse and in this way can call a passing Fox to within a short distance of their place of concealment. My esteemed friend, Mr. William Brewster, has told me he has done this successfully, but I have never been able to accomplish the feat, probably from my inability to properly imitate the "squeak." An interesting account of an experiment of this character is given by Stone and Cram, who say:

"This morning, January 31, 1902, a little before noon I was crossing an open clayey pasture when I heard a crow in the distance give the call which means a fox in sight. Presently I saw Reynard himself trotting

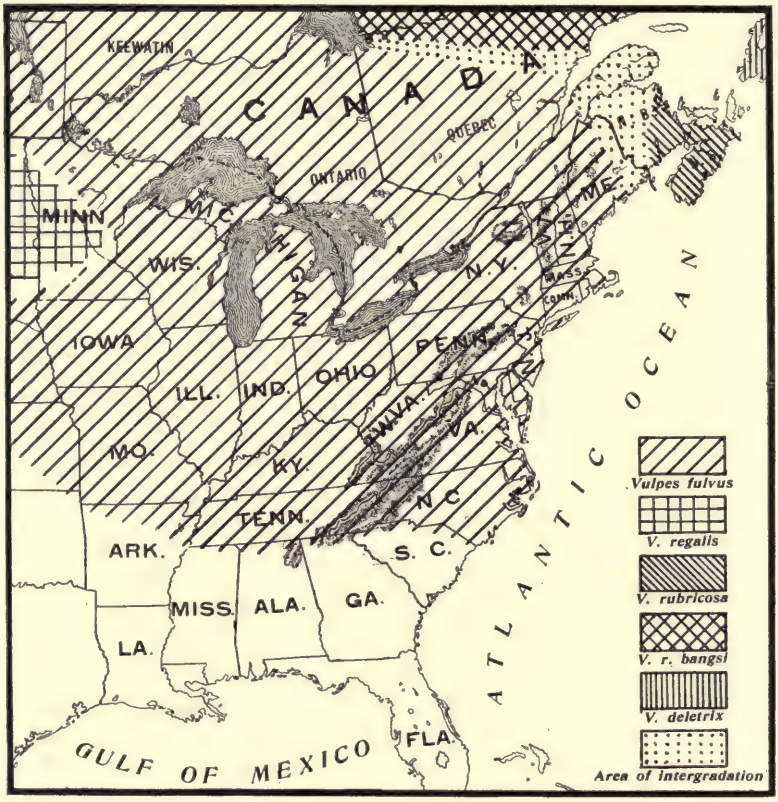
along at the edge of a pine grove: When he passed behind a thick clump I ran forward a little way and stopped, watching an opening among the trees where I felt pretty certain he would show himself again. Sure enough in a few minutes he appeared and trotted out across the meadows. He was at least one hundred and fifty yards away and going from me, but the air was still and I squeaked like a meadow mouse, hoping that perhaps his big ears might catch the sound even at that distance, though the sharpest human ears could scarcely have heard so faint a noise at a tenth part of the distance. Yet the fox heard it and stopped instantly, and turning came leaping lightly over the hassocks in my direction. Every few rods he stopped, cocking his ears above the sere meadow-grass to listen; then I would squeak a little lower each time, and instantly catching the direction of the sound, he would come trotting towards me, using greater caution than at first, and keeping under cover of the hassocks as if to avoid frightening his game. When he got within fifty yards there were no more hassocks or bunches of grass for concealment, only the smooth sheep-trimmed sod where I crouched in plain sight, with my back to what little sun shone through the flecked and mottled clouds that covered the sky. He looked at me sharply as if distrusting something, and if I had moved either my head or hand a fraction of an inch he would have been off like an arrow to the woods. But I held myself perfectly motionless, and when the expression of his shrewd, gray face and the set of his ears showed that his suspicions were subsiding, I squeaked once more, very faintly, calling him at last almost up to me. But now he saw there was certainly something wrong, and that I was neither a rock or stump or even an old scarecrow, so to make sure he circled round to get the wind of me, trusting more to his nostrils than to his eyesight. He was a large male, gray about the face and cheeks and perfectly black on his legs and the backs of his ears. His tail was a superb white-tipped brush, well grizzled with black. When I spoke to him he sprang into the air and went bounding away to the woods, then stopped and looked back at me for a few seconds before disappearing among the trees " (*l. c.*, p. 271).

Young Foxes are easily tamed and make interesting pets, but my experience has been that they are not affectionate and always more or less treacherous.

Specimens examined from Illinois and Wisconsin:

Illinois — Joliet, 1.

Wisconsin — (M. P. M.) Kelly Brook, Oconto Co., 5; (O. C.) Mercer, Iron Co. (skulls) 2; Bayfield Co. (skull), 1; Ashland Co. (skull), 1; Langlade Co. (skull), 2; Dunn Co. (skulls), 3; (S. C.) Beaver Dam, Dodge Co., 1; Cambria, 1 = 16.



Map illustrating approximate distribution of Red Foxes in eastern North America south of latitude 52°.

Vulpes fulvus (DESMAREST). Type locality — Virginia. Description as previously given.

Vulpes regalis MERRIAM. (Proc. Wash. Acad. Sci., II, 1900, p. 672.) Type locality — Elk River, Sherburn Co., Minnesota. Size large; color golden yellow, shading to whitish yellow on the face; legs strongly rusty brown or reddish brown.

Vulpes rubricosa (BANGS). (Science, N. S., VII, 1898, p. 272.) Type locality — Digby, Nova Scotia, Canada. Larger and darker than *fulvus;* rostrum and teeth larger.

Vulpes r. bangsi MERRIAM. (Proc. Wash. Acad. Sci., II, 1900, p. 667.) Type locality — Lance au Loup, Strait of Belle Isle, Labrador. "Similar to *fulvus*, but ears smaller; black of ears and feet more restricted." (Merriam.)

Vulpes deletrix BANGS. (Proc. Biol. Soc. Wash., XII, 1898, p. 36.) Type locality — Bay St. George, Newfoundland. Color very pale, light straw color, varying in places to yellow and buffy.

Genus **CANIS** Linnæus.

Canis Linnæus, Syst. Nat., X ed., I, 1758, p. 38. Type *Canis familiaris* Linnæus.

Temporal crests joining and extending in a single parietal ridge or sagittal crest;* frontal sinus present; upper incisors lobed or notched; nasals extending to or back of maxillaries; jaws elongated; nose elongated and tapering; postorbital process of frontal bone rounded, with end curving downward; pupil of eye round.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{4-4}$, M. $\frac{2-2}{3-3}=42$.

Canis nubilus SAY.

GRAY WOLF. TIMBER WOLF.

Canis nubilus SAY, Long's Exped. Rocky Mts., I, 1823, p. 169.

Canis occidentalis KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 654 (Illinois). BANGS, Amer. Nat., XXXII, 1898, p. 505. ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 557 (Indiana). SETON, Life Histories of Northern Animals, II, 1909, p. 749. WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 570 (Illinois).

Lupus occidentalis LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).

Canis occidentalis var. *griseo-albus* MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan).

Canis lupus STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 135 (Indiana).

Canis lupus nubilus RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 200 (Tennessee).

Canis nubilis MCATEE, Proc. Biol. Soc. Wash., XX, 1907, p. 6 (Indiana).

Canis griseus JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 27 (Wisconsin).

Type locality — Vicinity of Council Bluffs, Iowa.

Distribution — Not definitely determined.

Description — Adult: Size large; general color variable; the majority of specimens grayish or brownish gray or brownish white, with the middle portion of back to base of tail largely black; much pale rufous brown on legs and about the head and ears; terminal portion of tail tinged with pale rufous, the hairs at the tip mixed black and white; diameter of upper canine teeth at base (in adult) .50 inch or more; nose pad (in adult) more than 1.25 inch wide.

Measurements — Total length, about 56.50 to 63 in. (1400 to 1600 mm.); tail vertebræ, 15 to 16 in. (380 to 416 mm.); hind foot, about 10 in. (254 mm.). (Specimens from Michigan.)

* For illustration see p. 298.

Gray Wolf (*Canis nubilus*).

Remarks — Young pups of this species have the muzzle blackish at birth, fading in a few weeks to grayish; head grayish, in decided contrast to the black of the back, nose and ears; ears black at tip, fading to grayish in a few weeks; tail black, fading to gray, the tip black.

There is much variation in the color of Wolves from the same locality,* and from lack of specimens from large areas for comparison the distribution of the various supposed species cannot be definitely determined at the present time. It is by no means improbable that if a sufficiently large series could be assembled, those which occur in the United States might ultimately be considered geographical races of *one* species, *i. e.*, *Canis mexicanus* Linn. From the material examined I am unable to decide whether or not the Wolf which occurs in Wisconsin is separable from the Nebraska form. The skulls which I have seen from Nebraska are somewhat larger than any from Wisconsin or Michigan and have the postorbital processes of the frontal bone longer and less abruptly decurved, and the zygomatic breadth is relatively and actually greater. On the other hand a specimen from Kansas agrees very well with those from Wisconsin and it is not unlikely these cranial differences may be due to age or sex. For the present at least it would seem best to consider the form which occurs within our limits to be *Canis nubilus*.

CRANIAL MEASUREMENTS.

(In millimeters)

	Langlade Co., Wis. Field Mus. No. 930.	Champion Marquette Co., Mich Field Mus. No. 916.	Kansas. U. S. Nat. Mus. No. 11591.	Platte River. U. S. Nat. Mus. No. 2568.	Fort Kearney Nebraska. U. S. Nat. Mus. No. 1314.	Fort Kearney Nebraska. U. S. Nat. Mus. No. 884.
Greatest length of skull.....	250	254	245	254	240	240
Basal length.....	221	222	230	223	214	217
Basilar length of Hensel	218	215	222	218	205	210
Palatilar length.....	120	115	118	114	113	120
Zygomatic breadth.....	127	129	122	137	133	137
Mastoid breadth.....	81	78	77.5	80	78	80
Greatest breadth of brain case.....	68	68	62	66	66	65
Narrowest breadth of rostrum.....	45	42	45	45	46	45
Interorbital breadth.....	43	49	43	52	46	46
Breadth between ends of postorbital processes.....	53	68	53	70	60.4	65
Length of crown of upper carnassial.....	25	23	25	23	24	25

* While the majority of Florida Wolves (*C. ater*) were probably black, according to statements of my Indian friends, gray and brownish individuals were not uncommon. Robert Osceola killed a black Wolf with two black pups in the Big Cypress near the Everglades and another black Wolf with three pups, two of which were gray and one black, in the same locality.

The Gray Wolf, often called Timber Wolf, is common in northern Wisconsin and is claimed to be occasionally found in other parts of the state; but unless the animal is killed and examined by an expert, its resemblance to the Prairie Wolf, or Coyote, would cause us to regard records of its occurrence in the more settled districts of southern Wisconsin and Illinois with suspicion. While it is possible that straggling individuals have of late years been taken in Illinois, all efforts to secure a specimen have failed, and on several occasions the supposed "Timber Wolves" have proved upon examination to be Prairie Wolves (*C. latrans*). From time to time notices regarding the killing of so-called "Gray Wolves" have appeared in the newspapers in different parts of the state. As an example I quote the following from the *St. Louis Republican*, January 9, 1911:

"Two of the largest gray wolves ever killed in Bureau County [Illinois] were shot this week by David Hiltabrand, a farmer living near Tiskilwa. He was allowed the bounty of $12 from the County Treasury.

"The animals were captured after an exciting chase through the timber. One wolf weighed thirty-five pounds and the other thirty-three. The carcasses were viewed with considerable curiosity as wolves have been scarce in that vicinity for many years."

The weight given for these animals would indicate that they were Prairie Wolves (*C. latrans*).

Judge R. Magoon Barnes of Lacon, Marshall Co., Illinois, informs me that a large Wolf was killed a few miles from Lacon in 1907; four or five were reported in 1908, and an equal number in 1909–10, He did not see the specimens.

Mr. E. J. Chansler of Bicknell, Indiana, writes, "There was a large, wild Timber Wolf killed one and one half miles south of Vincennes on the Illinois side of the River about the year 1883. It had been killing cattle or hogs and the parties watched for it one night and shot it. It was mounted and kept by Mr. Ed. Bravagle of Main St., Vincennes, Indiana."

Wood says, "During the years 1883 to 1905 inclusive, bounties were paid on 159 wolves* killed in Champaign County." (*l. c.*, p. 570).

Kennicott (1854) gives it as formerly common in Cook County and, states it was "found throughout the state." (*l. c.*, p. 578.) Hahn gives several supposed records for Indiana (*l. c.*, pp. 558–559); and McAtee states (apparently on hearsay evidence) that a female and a litter of young were taken in Brown Co., Indiana, in 1902 (*l. c.*, p. 6).

I am indebted to Mr. Otto Widmann of St. Louis for a dozen or more

* We may assume that the majority, if not all of these animals, were Prairie Wolves (*C. latrans*).

newspaper clippings of a similar character recording the killing of "Wolves" in northern Missouri and Illinois. Wolves were claimed to have been killed in Nauvoo, Sterling and Whiteside counties, but as no weights or measurements were given, we are left in doubt as to the species.

I am informed by Mr. James M. Lacey of Bath, Illinois, that some twelve years ago he killed a "big Gray Wolf" near Moscow Lake, in that locality which he describes as being "as tall as a large pointer dog." Weight is given to this record from the fact that Mr. Lacey is an experienced hunter and is familiar with Prairie Wolves which were not uncommon in that locality.

Of its occurrence in considerable numbers in northern Wisconsin, however, there is no question, and records are too numerous to be enumerated in detail. I have examined specimens or skulls of animals of this species taken in Ashland, Oneida and Langlade counties. Jackson records it also from Forest and Bayfield counties, and I have reliable information of its occurrence in Wisconsin at least as far south as Buffalo County. From a large number of letters received from reliable persons regarding these animals, I quote the following excerpts:

Mr. John Weber of Forestville, Door Co., informs me he killed 14 Gray Wolves in the winter of 1907.

Mr. N. L. Kinney of Eagle River, Vilas Co., under date of February 9, 1910, writes: "We have a large pack of Timber Wolves here this winter that are making great havoc among the Deer, but so far only two have been killed." In a previous letter he informed me that a Gray Wolf weighing 98 pounds was killed in January, 1906, and a larger one, which was not weighed, in January, 1907.

Mr. J. Hobbs of Medford, Taylor County, states that Gray Wolves are not uncommon in that county.

Several correspondents report them common in Iron, Bayfield, Douglas and Burnett counties.

Mr. F. E. Munroe, county clerk at Ladysmith, Rusk Co., informs me that Gray Wolves are not uncommon in the county and that on February 20, 1907, he paid bounty on two killed that week.

Gray Wolves, or Timber Wolves, as they are often called, are wandering animals, which frequent alike both prairie and timbered country wherever they can find game. In the old days in the central plain region of the United States, Wolves were very numerous and preyed largely upon Buffalo, but since the extermination of that species their descendents have turned their attention to Cattle and Sheep. In wooded sections they kill many Deer, as well as smaller animals, such as Hares and Foxes.

Wolves rarely lie in wait for their prey, but usually hunt in packs, at least in the winter, and run down their game, following the trail like hounds. In the vicinity of a ranch, where Sheep or Cattle can be had, they have learned by experience that little effort is required to secure food and in such cases often hunt alone or in pairs, doing their work in a stealthy manner. But when hunting a Deer they take the trail openly, trusting to their power of endurance to pursue the animal until it becomes exhausted. A hunt of this character is described by Mr. Ernest Thompson Seton who says,* "An instance in point was related to me by Gordon M. Wright, of Carberry, Man. During the winter of 1865 he was logging at Sturgeon Lake, Ont. One Sunday he and some companions strolled out on the ice of the lake to look at the logs there. They heard the hunting cry of Wolves, then a Deer (a female) darted from the woods to the open ice. Her sides were heaving, her tongue out, and her legs cut with the slight crust on the snow. Evidently she was hard pressed. She was coming towards them but one of the men gave a shout which caused her to sheer off. A minute later six Timber-wolves appeared galloping on her trail, heads low, tails horizontal, and howling continuously. They were uttering their hunting cry, but as soon as they saw the Deer they broke into a louder, different note, left the trail, and made straight for her. Five of the Wolves were abreast and one that seemed much darker was behind. Within half a mile they overtook her and pulled her down, all seemed to seize her at once. For a few minutes she bleated like a lamb in distress; after that the only sound was the snarling and crunching of the Wolves as they feasted. Within fifteen minutes nothing was left of the Deer but hair and some of the larger bones, and the Wolves fighting among themselves for even these. Then they scattered, each going a quarter of a mile or so, no two in the same direction, and those that remained in view curled up there on the open lake to sleep. This happened about ten o'clock in the morning within three hundred yards of several witnesses."

Gray Wolves make their dens in caves, hollow logs, or burrows in the ground. The young are born in April and usually number from 6 to 8, although as many as 13 have been found in a litter.

Mr. Vernon Bailey states that in 1907 litters of Wolf pups were found in the Michigan peninsular in Marquette and Dickinson counties, and that during the year 34 Wolves were killed in Ontonagan County and 54 in Luce County.† A full grown Gray Wolf in northern Wisconsin or Michigan will weigh from 70 to 100 pounds, and Seton records one

* Life Histories of Northern Animals, II, 1909, pp. 755–756.

† U. S. Dept. Agr., Bureau Biol. Surv., Circular, No. 63, 1908.

weighing 150 pounds. (*l. c.*, p. 750.) The so-called "Gray Wolves" reported killed, which weigh less than 50 pounds, are probably Coyotes.

The following directions for trapping and poisoning Wolves and Coyotes are given by Mr. Vernon Bailey (*l. c.*, pp. 8–9–10):

TRAPPING.

"For wolves the best No. 4 double-spring trap with heavy welded or special wolf chain should be used. If the trap is to be fastened to a stationary object, the chain should have a swivel at each end. If to a drag, one swivel next the trap is enough. Always use a drag if possible. The best is a stone of 30 or 40 pounds weight, to which the chain is securely wired. A long oval stone is best. A piece of telegraph wire or smooth fence wire 5 or 6 feet long should be passed around one end of the stone; then doubled through the trap ring, with a twist to hold the ring in the middle; then around the other end of the stone and back on the opposite side to connect with the first loop. If properly fastened, a jerk on the trap tends to draw together and tighten the loops, and the spring of the connecting wire prevents a sudden jar that might break trap or chain. If an oval stone is not at hand, a triangular or square stone may be used by passing the wire over the three or four sides and securely connecting it above and below.

"If no stones are to be had and it is necessary to stake the traps, twisted iron stakes that can be driven below the surface of the ground should be used. They should be of good iron straps, at least 18 inches long, three-fourths of an inch wide, and three-sixteenths of an inch thick, turned over at the top into a P-shaped loop to connect with the ring of the trap chain.

"When possible, place the trap between two tufts of grass or weeds, so it can readily be approached from one side only. Bury the stone, chain, and trap out of sight, with the trap nearest the runway where the wolves follow a trail or road, cross a narrow pass, or visit a carcass. The trap should be flush with the surface of the ground and the jaws and pan covered with a piece of paper to keep the earth from clogging under the pan. Fine earth should be then sprinkled over the paper until all traces of trap and paper are concealed. The surface of the ground and surroundings should appear as nearly as possible undisturbed. The dust may be given a natural appearance by sprinkling it with water. Touching the ground or other objects with the hands, spitting near the trap, or in any way leaving a trace of human odors near by should be avoided. Old, well-scented gloves should be worn, and a little of the scent used for the traps should be rubbed on the shoe soles. A

piece of old cowhide may be used to stand on and to pile the loose earth on while burying the drag and trap.

"For coyotes use the best No. 3 double spring-trap, unless in a wolf country, where it is better to use a trap strong enough to hold a wolf. In setting the trap use the same method and bait as for wolves, but the traps may be staked or fastened to a stationary object with more safety.

USE OF SCENTS.

"Success in trapping depends largely on the use of a scent that will attract wolves and coyotes to the traps and keep them tramping and pawing there until caught. Meat bait alone is of little use, and often, indeed, scares the animals away. Of the many scents and combinations tested the fetid bait has proved most successful.

"*Fetid bait.* Place half a pound of raw beef or venison in a wide-mouthed bottle and let it stand in a warm place (but not in the sun) for two to six weeks, or until it is thoroughly decayed and the odor has become as offensive as possible. When decomposition has reached the proper stage, add a quart of sperm oil or any liquid animal oil. Lard oil may be used, but prairie-dog oil is better. Then add 1 ounce of pulverized asafetida and one ounce of tincture of Siberian musk or Tonquin musk. If this can not be procured, use in its place 1 ounce of dry, pulverized castoreum (beaver castor) or 1 ounce of the common musk sold for perfumery. Mix well and bottle securely until used.

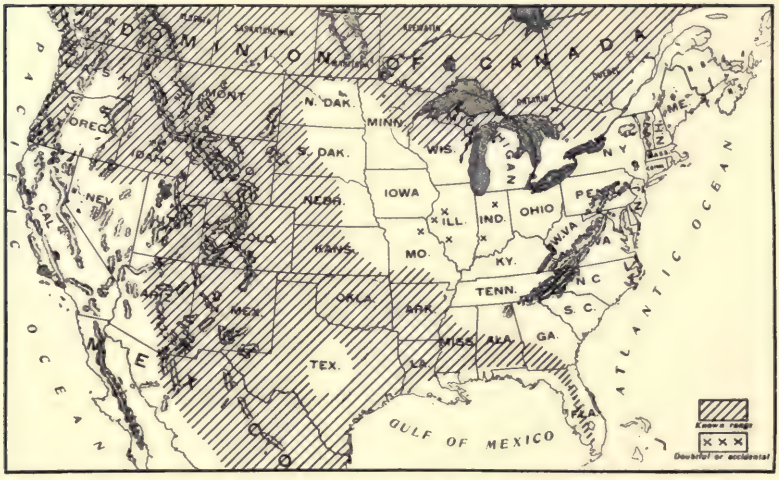
"After setting the trap, apply the scent with a stick or straw or by pouring from the bottle to the grass, weeds, or ground on the side of the trap opposite that from which the wolf would naturally approach. Never put scent on the trap, as the first impulse of the wolf after snuffing the scent is to roll on it.

"This bait is very attractive also to cattle and horses, which are sure to tramp over and paw out the traps, if set where they can be reached.

POISONING.

"No poisoning has yet proven so effective as pure sulphate of strychnine, provided the proper dose is used. The most effective dose is 4 grains for wolves and 2 grains for coyotes. The common 3-grain gelatine capsules sold by druggists will hold, if well filled, 4 grains of strychnine and are better than the larger capsules. The regular two-grain capsules should be used for coyotes. The capsules should be filled, securely capped, and every trace of the intensely bitter drug wiped from the outside. Each capsule should be inserted in a piece

of beef suet the size of a walnut and the cavity securely closed, to keep out the moisture. Lean meat should not be used, as the juice soon dissolves the gelatine of the capsule. The necessary number of poisoned baits may be prepared and carried in a tin can or pail. They should never be handled except with gloved hands or forceps. The baits may be dropped from horseback along a scented drag line made by dragging an old bone or piece of hide well saturated with the fetid scent, or they may be placed around or partly under any carcass on which the wolves or coyotes are feeding, or along trails which they are in the habit of following. Gelatine capsules quickly dissolve in the juices of the stomach; Strychnine taken on an empty stomach sometimes kills in a very few minutes, but on a full stomach its action is much slower, and the animal may have time to travel a considerable distance."



Map illustrating supposed distribution of Big Wolves in the United States, southern Canada and northern Mexico. The range limits of the various forms have not been satisfactorily determined.

Canis nubilus SAY. (Long's Exped. Rocky Mts., I, 1823, p. 169.) Type locality — Vicinity of Council Bluffs, Iowa.

Canis occidentalis (RICHARDSON). (Fauna Bor. Amer. I, 1829, pp. 60–65.) Type locality — Northern North America.

Canis albus (SABINE). (Franklin's Narrative, Journ. to Polar Sea, 1823, p. 655.) Type locality — Fort Enterprise, Mackenzie, Canada.

Canis ater (RICHARDSON). (Fauna Bor. Amer., I, 1829, p. 70.) Type locality — Not definite, but now generally restricted to Florida.

Canis mexicanus LINN. (Syst. Nat., XII ed., I, 1766, p. 60.) Type locality — Mexico.

Canis rufus (AUD. and BACH.). (Quadrupeds of N. Amer., II, 1851, p. 240.) Type locality — Texas. Smaller and more reddish in color than other members of this group. In size it is small for a "big wolf" and large for a Coyote.

Specimens examined from Wisconsin and adjoining states:

Wisconsin — Antigo, Langlade Co. (skull), 1; (M. P. M.) Ashland Co., 1; Rhinelander, Oneida Co., 1; Three Lakes, Oneida Co., 1; (S. C.) Ashland Co. (skulls), 2 = 6.

Michigan — Park Siding, 1; White Deer Lake, near Champion, Marquette Co., 1 = 2.

Canis latrans SAY.

PRAIRIE WOLF. COYOTE.

Canis latrans SAY, Long's Exped. Rocky Mts., I, 1823, p. 168. KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 654 (Illinois). MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 220 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 181 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 80 (Minnesota). BUTLER, Proc. Ind. Acad. Sci., 1894 (1895), p. 85 (Indiana). MERRIAM, Proc. Biol. Soc. Wash., XI, 1897, p. 23. JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 27 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 141 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 561 (Indiana). SETON, Life Histories of Northern Animals, II, 1909, p. 789. HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 32 (Illinois). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 571 (Illinois).

Lupus latrans LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin).

Type locality — Vicinity of Council Bluffs, Pottawattamie County, Iowa.

Distribution — Ranges from Illinois, northwestern Indiana and northern Missouri north to Lake Superior and in the Northwest at least to the base of the Rocky Mountains in Alberta, and probably much farther west; limits of its range not definitely known.

Description — *Adult:* Resembles the Gray Wolf, *Canis nubilus*, but is decidedly smaller; general color grayish tawny, back with the hairs tipped with black; top of head from front of eyes to ears grizzled gray; ears fulvous brown, with a few black hairs; under parts whitish, with more or less white-tipped hairs on throat; outer side of hind legs and feet fulvous brown. Color more or less variable, but size will usually distinguish it from *C. occidentalis*, which is the only species with which it might be confounded; diameter of upper canine teeth at base (in adult) less than .50 inch; width of nose pad (in adult) less than 1.25 in.

Young pups have the muzzle tawny, the head yellowish gray, back of ears dark brown soon fading to yellowish brown; tail black, soon changing to grayish, with the tip black.

Measurements — Total length, about 44 to 49.50 in. (1110 to 1250 mm.); tail vertebræ, 11 to 14.50 in. (280 to 370 mm.); hind foot, about 7.50 in. (190 mm.).

CRANIAL MEASUREMENTS.*

	Linn County, Iowa. Coll. Coe College Museum, Cedar Rapids.	Linn County, Iowa. Coll. Coe College Museum, Cedar Rapids.	Marinette Co. Wisconsin. Field Museum Collection.
Greatest length of skull	174 mm.	165 mm.	174 mm.
Basal length	160 "	152 "	153 "
Basilar length of Hensel	153 "	148 "	150 "
Palatilar length	81 "	79 "	82 "
Zygomatic breadth	86 "	80 "	88 "
Mastoid breadth	55 "	52 "	56 "
Breadth of brain case	54 "	53 "	54 "
Narrowest breadth of rostrum	30 "	27 "	26 "
Interorbital breadth	26 "	25 "	27 "
Breadth between ends of postorbital processes	36 "	35 "	40 "
Length of crown of upper carnassial	18 "	18 "	19 "

The sexes of the above skulls are unfortunately unknown, although they are probably females. They are, however, decidedly smaller than two skulls from Minnesota supposed to belong to this species.

The range of the Prairie Wolf or Coyote formerly included the greater portion of Illinois and Wisconsin and it is still to be found in more or less numbers in many sparsely settled localities in both states.† There is a specimen in the Northwestern University collection at Evanston, Illinois, taken near Geneva, Kane Co., Illinois. Mr. T. D. Shipton of Hanover informs me that they are of regular occurrence in parts of Jo Daviess Co., but not plentiful. Mr. W. L. Weaver of Morrison, Whiteside Co., reports them as being found to a limited extent in that locality. Mr. W. E. Nixon, county clerk, Toulon, Ill., informs me they are occasionally killed in Stark County. Mr. A. H. Howell states that several were killed two or three years ago near Kansas, Edgar Co. Kennicott, in his list published in 1854, states that it was abundant in Cook County within ten years (*l. c.*, p. 578).

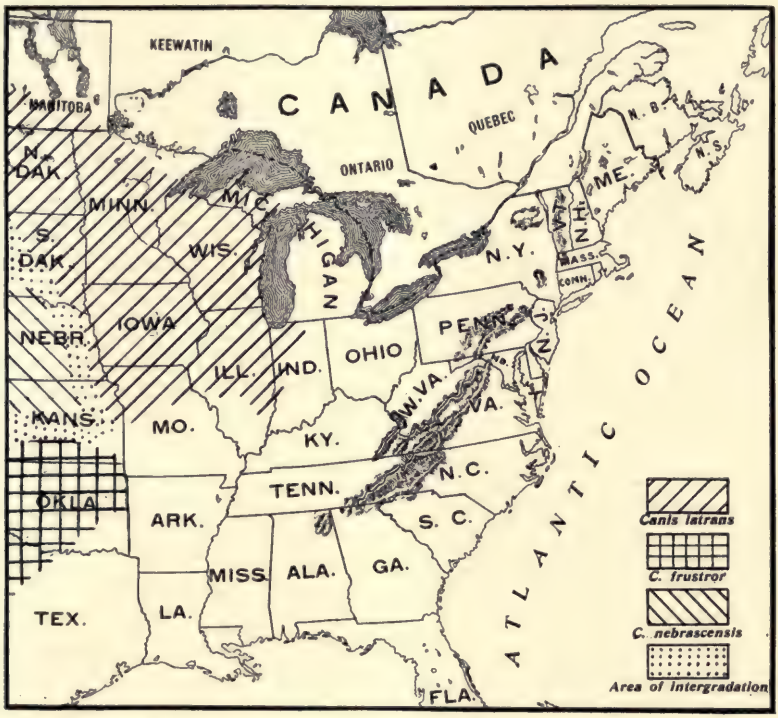
In Wisconsin it is common in some localities. Hollister states that there are three skulls in the Biological Survey collection from Eagle River, Vilas Co., collected in 1907, and a skin and skull from Delavan taken in 1898. He is of the opinion that it is increasing in numbers in southern Wisconsin, notably in Walworth County where several litters

* For definition of terms see Glossary, p. 489.

† It is probable that nearly all the so-called " Gray Wolves" reported by various newspapers as having been killed, from time to time, in Illinois are this species.

Prairie Wolf or Coyote (*Canis latrans*).

of young are taken each year (*l. c.*, 1908, p. 141). I have examined specimens from Sauk and Marinette counties, and Jackson says it occurs in nearly all parts of southern Wisconsin, stating he has seen specimens from Green County and that Mr. Clark reports it from Dunn County (*l. c.*, p. 27); and I have been informed by reliable hunters and others that it is not uncommon in Douglas, Bayfield and Ashland counties, but I have seen no specimens from these localities.



Map illustrating the supposed distribution of Prairie Wolves or Coyotes in eastern United States.

Canis latrans SAY. Type locality — Vicinity of Council Bluffs, Iowa. Description as previously given.

Canis nebracensis MERRIAM. (Science, N. Ser., VIII, 1898, p. 782.) Type locality — Johnstown, Brown Co., Nebraska. Similar to *latrans* but paler; back of ears buff instead of fulvous.

Canis n. texensis BAILEY. (N. Amer. Fauna, No. 25, 1905, p. 175.) Type locality — 45 miles southwest of Corpus Christi, Texas. Darker and with lighter dentition than *nebracensis;* smaller and more fulvous than *latrans.*

Canis frustror WOODHOUSE. (Proc. Acad. Nat. Scien. Phila., 1851, p. 147.) Type locality — Fort Gibson, junction of the Neosho and Arkansas rivers, Indian Territory. Muzzle cinnamon rufous; carnassials and premolars decidedly smaller than in *latrans.*

The Prairie Wolf, or Coyote, resembles the Timber Wolf, but is smaller; and while they occasionally kill Calves, Colts and Sheep and even full-grown Deer, the greater portion of their food consists of smaller animals, such as Mice, Rabbits, frogs, birds and eggs, etc., as well as dead fish and carrion of any kind.

Unlike the Timber Wolf* the Coyote habitually barks, and in localities where they are common their dog-like barking is a familiar sound about the camp. They howl mostly at night, but they occasionally do so on cloudy days or before a storm. They breed from early in April until the middle of May (Bailey says April 1 to May 15, in western United States) and the number of pups born in a litter varies from 4 to 9, generally 5 or 6. The den is usually a hole in the ground, either dug by themselves or a burrow of some other animal which they enlarge, although occasionally a natural cave is used, or in a wooded country the base of a hollow tree. The pups when taken young are easily tamed and make interesting pets.

Specimens examined from Illinois, Wisconsin and adjoining states:
Wisconsin — Pembine, Marinette Co. (skull), 1; (M. P. M.) Prairie du Sac, Sauk Co., 1 = 2.
Minnesota — Mankato, 1; (B. S.) Elk River, 1 = 2.
Illinois — Geneva, Kane Co., 1. (Northwestern University collection.)
Iowa—Linn Co. (skulls), 2 (Coe College collection, Cedar Rapids.)

* It is claimed that Timber Wolves bark at times. See Seton, Life Histories of Northern Animals, II, 1909, p. 814.

Family MUSTELIDÆ. Otters, Minks, Weasels, Skunks, Badgers, etc.

The *Mustelidæ* comprise a rather large family which is widely distributed, representatives being found throughout the world except in the Australian region and Madagascar. The family is divided into several well marked subfamilies which, while osteologically closely related, differ widely in appearance and habits. All North American *Mustelidæ* are now generally considered to belong to three subfamilies: *Lutrinæ*, the Otters; *Melinæ*, the Skunks and Badgers; and *Mustelinæ* which includes the Minks, Weasels, Marten, Fisher and Wolverine. All are fur-bearing animals having a commercial value, the most highly prized being the Sea Otter, *Latax lutris* (a species very different from the semi-aquatic Otter which occurs within our limits). This splendid animal is confined to the north Pacific Ocean but is fast disappearing. Its rarity may be judged by the fact that notwithstanding the great value of its fur, a single fine skin being valued at from 1000 to 2000 dollars, during the year 1909 only 37 skins are known to have been secured by fur dealers.

The members of this family possess anal glands, the secretions of which have a noxious odor. This character reaches a high development in the Skunks, which are able to eject the fetid fluid to a distance of ten or fifteen feet. These odoriferous glands are more or less modified in different genera. In the Weasels, Wolverine and American Badgers, for example, the secretion is noxious, but can not be forcibly ejected, being allowed to escape from the glands when the animal is enraged or excited. In the various subfamilies there is a noticable difference in the character of the feet and claws but all members of the family have five toes on both fore and hind feet.

With rare exceptions all species of *Mustelidæ* have but a single molar in the upper jaw and occasionally only one in the lower. The audital bullæ are depressed and but slightly inflated; alisphenoid canal absent; oss penis present and large; cæcum absent; placenta zonary and deciduate. Except in the Otters the kidneys are of simple structure.

In the Skunks the secretion is an acid liquid golden yellow in color, having an exceedingly strong, sickening odor. Clothing, which has been tainted by it, gives evidence of the fact for a surprising length of time, especially in hot weather or when left near a fire. The fluid is extremely irritating to the eye, and cases have been re-

ported where the sight of both dogs and men have been severely injured by it and in some cases destroyed. Permanent blindness is, however, the exception, and in most cases with proper treatment the inflamation soon subsides.

KEY TO THE SUBFAMILIES AND GENERA OF MUSTELIDÆ.

Subfamily LUTRINÆ. Otters.

Otter.

General color rich brown; total length about 42 inches; tail about 15 inches; toes webbed; cheek teeth (molars and premolars) 5 on each side of both jaws;

Pm. $\frac{4-4}{3-3}$, M. $\frac{1-1}{2-2}$. Genus LUTRA, p. 330.

Subfamily MELINÆ. Skunks and Badgers.

Skunk.

Color black and white, back with two white stripes; length usually 22 to 25 inches; tail 7 to 9 inches.
Genus MEPHITIS, p. 337.

Spotted Skunk.

Color black and white, back with four broken white stripes; length usually 18 to 21 inches.
Genus SPILOGALE, p. 346.

Badger.

Color grizzly gray with some blackish brown and white markings; length usually 26 to 29 inches; tail about 5 inches.
Genus TAXIDEA, p. 348.

Subfamily MUSTELINÆ. Wolverine, Martens, Fisher, Minks and Weasels.

Wolverine.

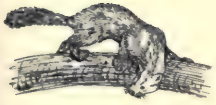
General color brown with more or less yellowish white marking; total length usually 28 to 33 inches; tail about 8 inches.

Genus GULO, p. 352.

Fisher.

General color dark brown; legs, lower back and belly blackish; cheek teeth 5 above and 6 below on each side of jaw; total length about 34 inches.

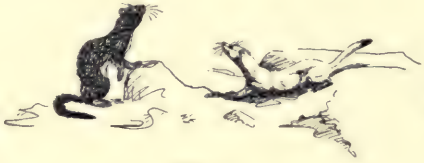
Genus MUSTELA, p. 381.



Marten.

General color yellowish brown shading to blackish on legs and tail; head more or less grayish or yellowish; a yellowish or buffy patch on throat and breast; cheek teeth 5 above and 6 below on each side of jaw; total length usually 22 to 25 inches.

Genus MUSTELA, p. 381.



Weasel.

Cheek teeth 4 above and 5 below on each side of jaw; general color (in summer) brown above; under parts white or yellowish; or (in winter) general color white; total length from 7 to 16 inches.

Genus PUTORIUS, p. 358.

Mink.

Cheek teeth 4 above and 5 below on each side of jaw; general color brown; under parts brown with generally a white spot on chin and often another between the fore legs; total length usually from 18 to 25 inches.

Genus PUTORIUS, (Subgenus LUTREOLA), p. 361.

Subfamily LUTRINÆ. Otters.

Otters are semi-aquatic,* fish-eating mammals which are much hunted on account of the fine quality of their fur. There are at least two genera and a number of species distributed throughout many parts of the world, including several Neotropical forms. Of the eight recognized species and subspecies in North America, one species and perhaps one subspecies are found within our limits. They are generally taken in traps, although Otter hunting with dogs trained for the purpose was formerly a common sport in England.

Genus **LUTRA** Brisson.

Lutra Brisson, Regn. Anim., 2nd ed., 1762, p. 201. Type *Mustela lutra* Linn.

Body long; legs short; toes webbed; soles of feet hairy; tail long and rounded, thick at base and tapering; head broad; skull flattened; rostrum short; audital bullæ much flattened; upper carnassial with tricuspid blade and a large inner lobe; upper molar large, first upper premolar very small; general color brown. (For cut of skull see p. 276.)

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{3-3}$, M. $\frac{1-1}{2-2} = 36$.

Lutra canadensis (SCHREBER).

OTTER. CANADA OTTER.

Mustela lutra canadensis SCHREBER, Säugthiere, 1776, pl. CXXVI B.

Lutra Canadensis LAPHAM; Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 339 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 655 (Illinois).

Lutra canadensis KENNICOTT, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 246 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 183 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 129 (Minnesota). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin). HAHN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 463 (N. W. Indiana). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 27 (Wisconsin). *Ib.*, VIII, 1910, p. 89 (Wisconsin). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 581 (Illinois).

Lutra hudsonica EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 138 (Indiana).

* The Sea Otter (*L. lutris*) passes so much of its life in the water that it can fairly be called aquatic.

Type locality — Eastern Canada.

Distribution — Nearly the whole of North America, Virginia, Illinois, Missouri and Texas, north to Labrador and Hudson Bay and in the Northwest to the Arctic Circle; replaced in the Southern states, Florida and the Pacific Coast by closely allied forms.

Description — General color rich dark brown; the under parts lighter brown than the back, and the legs and feet somewhat darker; throat grayish brown, shading into grayish white on the lips and chin; toes webbed.

Measurements — Total length, about 37 to 41 in. (940 to 1040 mm.); tail vertebræ, 12 to 13 in. (304 to 330 mm.); hind foot, about 4 in. (101.6 mm.).

Otters were formerly numerous in localities where there was water throughout Illinois and Wisconsin, but at the present time their range is probably restricted to the greater portion of Wisconsin and extreme southern Illinois. It is not unlikely, however, that stragglers may still be found in other parts of Illinois, as Hahn states that specimens are occasionally taken in northern Indiana (*l. c.*, 1907, p. 463). I am informed by hunters that Otters are still to be found in Alexander and Union counties, and Wood states that during the winter of 1907–8 several were taken in the cypress swamps of Alexander County (*l. c.*, p. 581). Otters from southern Illinois will probably be found to approach *L. c. lataxina*, a slightly different southern race, but for lack of specimens from that locality I am unable to decide this question.

In Wisconsin it is not uncommon in the northern portion of the state, but rare in the southern. Jackson says "There was an Otter slide on the banks of Lake Koshkonong during the summer of 1901," and records specimens from Bayfield and Oneida counties (*l. c.*, 1908, p. 27). I have examined specimens from Walworth, Arena, Bayfield, Forest, Douglas and Langlade counties, and Dr. H. V. Ogden has a skull in his collection from Waterford, Racine Co. Jackson records specimens of two males killed February 12, 1908, near Crandon, Forest Co., and says they are reported as quite common in the vicinity of Black Oak Lake and Lake Mamie during the winter of 1908–9 (*l. c.*, 1910, p. 89).

The Otter is a semi-aquatic animal and is very seldom found away from water, although it is a great traveler and will often go overland for a considerable distance from one stream to another. Its food consists largely of fish which it catches under water with great dexterity. Merriam says: "It can remain under water almost as long as a Loon, and I have known one to swim nearly a quarter of a mile without showing its head above the surface. Its food consists chiefly of various species of fish, and the lobster-like fresh water Decapod, called the

Canada Otter (*Lutra canadensis*).

Cray-fish. When unable to procure these in sufficient quantity, it devours frogs, and is said to depopulate the poultry yard, and even prey upon young lambs. It can dive and swim under water with such speed and agility, that it can overtake and secure, with great ease and certainty, almost any of our fresh water fishes." *

"Otter slides," about which much has been written, are smooth, worn pathways on the sides of banks of streams, which are used by these animals. Many writers claim to have seen them amusing themselves sliding down these places much as a boy enjoys sliding down hill in winter. Audubon and Bachman state that they once saw a pair of these animals sliding down a bank and say, "We counted each one making twenty-two slides before we disturbed their sportive occupation." †

Kennicott says: "This curious habit seems to be indulged in by the Otter at all times, when a suitable place can be found, though more in the love season than any other. It climbs to the top of some steep bank, made slippery by the mud and water from its own body, or, in winter, by snow and ice, and lying down with its fore-feet bent under, slides headlong to the bottom. Trappers inform me that they have often seen the Otter thus engaged for an hour or more, scrambling eagerly to the top after each descent and greatly enjoying the sport." (*l. c.*, pp. 247–248.)

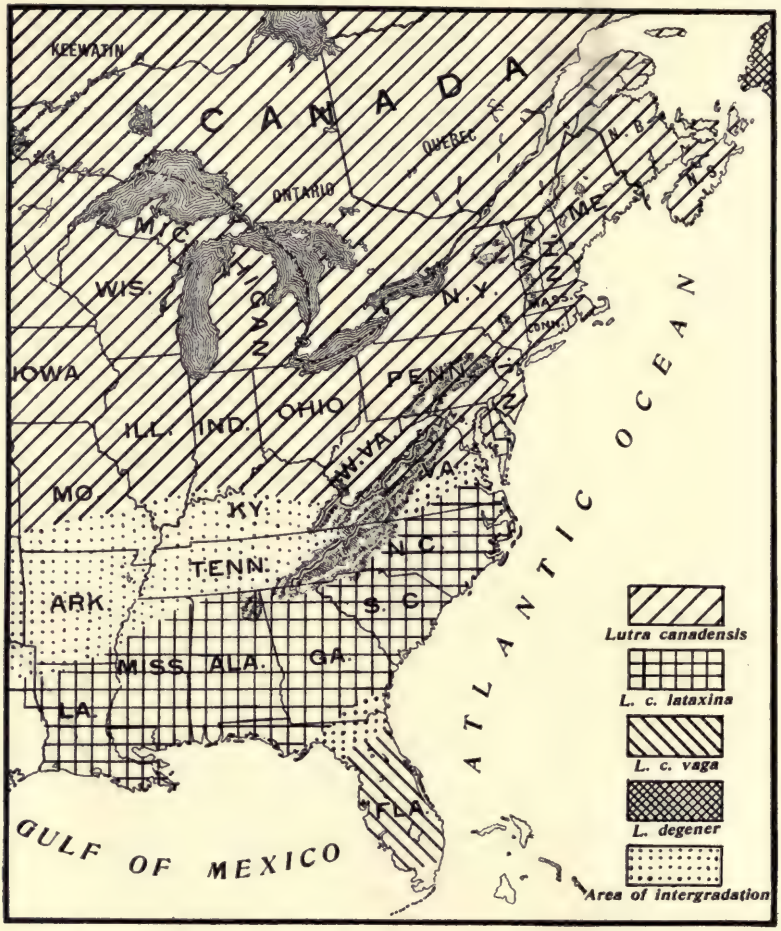
The Otter makes a home in a burrow in the bank of some stream or pond. The young, which number from two to three, are usually born in April and when first born their eyes are closed. When taken very young they become very tame and often affectionate, but if not captured until six or eight weeks old they rarely become gentle and are usually treacherous. I have owned a number of young Otters at various times and all of them would readily eat raw meat, but they preferred fish. They often uttered a low tremulous cry resembling that of a fretful baby. One, which we "brought up on a bottle," would follow my wife about the garden and into the house and seemed to take great delight in being petted.

The skins of these animals are quite valuable and in much demand, as they make handsome and durable furs. Although much less common than formerly, great numbers of these animals are still trapped in Canada. From 1895 to 1905 the Hudson Bay Company secured between 85,000 and 90,000 skins, or an average of nearly 9,000 skins per year.‡

* Mamm. Adirondack Reg., 1886, pp. 87–88.

† Quadrupeds of North Amer., II, 1851, p. 8.

‡ Up to the year 1906, from 200 to 300 Otter skins were annually secured by local dealers from the Indians in southeastern Florida, but I am informed that since then the number has decidedly decreased.



Map illustrating approximate distribution of Otters in eastern North America. The range of *Lutra canadensis* extends much farther north than shown on the map.

Lutra canadensis (SCHREBER). Type locality — Eastern Canada. Description as previously given.

Lutra c. lataxina (F. CUVIER). (Dict. Scien. Nat., XXVII, 1823, p. 242.) Type locality — South Carolina. Size slightly smaller and color lighter brown than *canadensis;* under side of foot more sparsely haired.

Lutra c. vaga (BANGS). (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 224.) Type locality — Micco, Brevard Co., Florida. General color more reddish brown than *canadensis.*

Lutra degener BANGS. (Proc. Biol. Soc. Wash., XII, 1898, p. 35.) Type locality — Bay St. George, Newfoundland. A small insular form.

Specimens examined from Wisconsin:

Wisconsin — Eagle Lake, 1; (M. P. M.) Prairie du Lac, 1; Walworth Co., 1; Arena, Iowa Co., 1; (O. C.) Drummond, Bayfield Co. (skull), 1; Gordon, Douglas Co. (skull), 1; Langlade Co. (skull), 1 = 7.

Subfamily MELINÆ. Skunks and Badgers.

Members of this subfamily are found in both the Old and New World. They are burrowing animals and largely nocturnal in habits. The Skunks are notorious for their ability to eject a noxious smelling fluid for a considerable distance when angry or excited. The two glands containing this liquid are situated on each side of the rectum and are connected by a duct with a nipple-like papilla which can be voluntarily protruded from the anus. In young animals the removal of these glands is a comparatively simple operation.* When taken sufficiently young they make gentle and interesting pets.

The earliest mention of Skunks in North America seems to be the one given by Gabriel Sagard Theodat in 1636, in which he refers to these animals as Children of the Devil ("enfans du diable").† "Child of the Devil" appears to have been a recognized name for a Skunk among the French in Canada in early days, as it is so referred to by Charlevoix ‡ and others. The etymology of the name Skunk, by which it was known later, is obscure, but Dr. Cones suggests that it may have had its origin in the Cree Indian name "See cawk . . ., as the sound is not so very different though the literal discrepancy is great.' §

The Badgers, which also belong to this subfamily, comprise several genera and a number of species. The American Badger (*Taxidea*) with its four subspecies is confined to North America and is generically distinct from Old World forms. A species which occurs in Java (*Mydaus*

* I have successfully performed this operation on several occasions with species of both *Mephitis* and *Spilogale*.

† "Les enfans du diable, que les Hurons appellent Scangaresse, & le commun des Montagnais Babougi Manitou, ou Ouinesque, est un beste fort puante, de la grandeur d'un chat ou d'un ieune renard, mais elle a la teste un peu moins aiguë, & la peau couuerte d'un gros poil rude & enfumé, et sa grosse queuë retroussée de meśme, elle se cache en Hyuer sous la neige, & ne sort point qu'au commencement de la Lunedu mois de Mars, laquelle les Montagnais nomment Ouiniscon pismi, qui signifie la Lune de la Ouinesque. Cet animal, outre qu'il est de fort mauuaise odeur, est tres-malicieux & d'un laid regard, ils iettent aussi (à ce qu'on dit) parmy leurs excremens de petits serpens, longs & deliez, les quels ne viuent neant moins gueres long temps." (Hist. Canada, 1636, p. 748.)

‡ Nouv. France, V., 1744, p. 196.

§ Fur-bearing Animals, 1877, p. 221.

meliceps) has the power of ejecting a fetid liquid like the Skunks. In early days in England the so-called sport of Badger-baiting or "Drawing the Badger" was popular. A Badger was placed in a barrel and dogs attempted to pull him out. In these contests both dogs and Badger were usually badly bitten and often killed.

The European Badger (*Meles*) was well known to ancient writers, and some of their descriptions of it are curious. Writing in 1607 Edward Topsell says,* "He hath verie sharpe teeth, and is therefore accounted a deepe-biting beaste. His back is broad, his legs (as some say) longer on the right side than on the left, and therefore he runneth best when he getteth to the side of a hill, or a cart-road-away."

KEY TO THE SKUNKS

WHICH OCCUR IN ILLINOIS OR WISCONSIN, OR WHICH MAY BE LOOKED FOR WITHIN OUR LIMITS.

GROUP 1. Back usually with two white stripes joining at the shoulder; total length more than 21 inches.

Tail vertebræ 9 inches or more in length; tail ending with a blunt brush, end entirely black without white pencil; palate ending with even curve, without median spine; zygomata widely expanded at posterior end and slanting abruptly forward; white stripes of body extending down sides of tail. Occurs from northern edge of Illinois northward throughout Wisconsin.

HUDSONIAN SKUNK, NORTHERN SKUNK.
Mephitis hudsonica, p. 340.

Tail vertebræ usually less than 9 inches long; tail usually wholly black, the white stripes of body generally not extending on the sides; end of tail occasionally with a white pencil; palate ending with even curve, without median spine; zygomata less widely expanded at posterior end than in *hudsonica* and with bend less abrupt. Occurs in Illinois and southern Wisconsin.

ILLINOIS SKUNK. *Mephitis mephitis avia*, p. 344.

GROUP 2. Back with four broken white stripes; size comparatively small, less than 21 inches.

End of tail broadly white; 4 well-marked white stripes on back, the median pair narrower than the outer pair. A southern species which is claimed to have been taken in southern Illinois. ALLEGHENIAN SPOTTED SKUNK.
Spilogale putorius, p. 346.

Tail wholly black or with very little white at the tip; general coloration showing much more black than in *putorius*, the white markings being much smaller and more broken. Has not yet been taken within our limits, but occurs in Iowa and south-eastern Minnesota and may be found in western Wisconsin.

PRAIRIE SPOTTED SKUNK.
Spilogale interrupta, p. 348.

* Historie of Foure Footed Beastes, London, 1607, p. 34.

It is not improbable that fairly typical examples of *Mephitis mephitis* may be found in northeastern Wisconsin and *M. m. putida* in eastern Illinois. In the regions mentioned intergradation is likely to occur and doubtful specimens should be sent to specialists for identification. The characters by which the two forms may be recognized are as follows:

GROUP 1. Back with two white stripes joining at the shoulder.

White stripes extending down sides of tail; tail tapering and the end white; zygomata relatively heavier than *hudsonica* but not so widely expanded; tail vertebræ averaging less than 9.50 inches; palate ending in even curve without median spine; total length generally 23 to 27 inches; tail vertebræ 7.50 to 9 inches. CANADA SKUNK. *Mephitis mephitis.*

White stripes of body usually not extending on tail; tail black, ending in a white pencil; *palate with distinct median spine;* tail averaging longer than in *mephitis;* total length 22 to 24.50 inches; tail vertebræ 8.50 to 9.75 inches. EASTERN SKUNK. *Mephitis mephitis putida.*

Genus **MEPHITIS** Cuvier.

Mephitis Cuvier, Leçons d'Anat. Comp., I, 1800, tab. I (facing page 322).

Body thick set; legs rather short; fur thick, color black and white, the white occasionally tinged with tawny or yellow; extent of white marking variable, usually two dorsal white stripes; tail bushy, claws curved; ears short; superior anal glands, containing defensive odorous secretions, highly developed. Skull somewhat arched, highest in the frontal region; upper molar larger than the carnassial, subquadrate, and broader than long; lower carnassial longer than high: bullæ flattened; auditory meatus tubular but not noticeably extending beyond the skull; posterior end of palate nearly on a line with back of last molar.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{1-1}{2-2}=34$.

Two forms of the large Skunks belonging to the genus *Mephitis* are known to occur in Illinois, and it is not unlikely that the range of two others, *mephitis* and *putida*, may be found to cross our border. No typical specimens of *putida* have, so far as known, been taken in Illinois, although it is given by Hahn as the common form occurring throughout Indiana, where, according to Howell its range meets that of the Illinois Skunk, *M. m. avia*. *Mephitis mephitis* is common in Ontario along the northern borders of the Great Lakes and it is by no means improbable that its range may be found to extend into the Michigan peninsula. A series of specimens from Green Bay, northeastern Wisconsin, are perplexing in that they are not typical of any

Skulls of Skunks belonging to the genus *Mephitis*.
1. *M. m. putida*;* 2. *M. m. avia*, 3. *M. mephitis*; 4. *M. hudsonica*.

* In *M. m. putida* the palatal spine is often more pronounced than is shown here.

form and apparently show marked intergradation. When the time comes that a sufficiently large series from various localities can be gathered together for comparison, it may be found that all of our large Skunks belonging to this genus are merely geographical races of one or possibly two species, four of which intergrade within our limits. For the laity it is perhaps as well to consider all the Skunks belonging to the genus *Mephitis*, which are found within our limits, to be either *hudsonica* or *avia*, but many specimens are not typical of either and possess characters more or less approaching *mephitis* or *putida*, as shown by the following brief descriptions of a series of Skunks in the Field Museum collection from Green Bay, Wisconsin. The measurements are in millimeters.

No. 11708, ♀ — Palate with distinct median spine, but zygomata widely expanded; white stripes extending on sides of tail about ⅓ its length; end of tail blunt and entirely black.

Total length, 625; tail vertebræ, 195; hind foot, 63.5.

No. 11706, ♀ — Palate with distinct median spine and skull similar to preceding; tail mostly black, but ending with a long white pencil.

Total length, 660; tail vertebræ, 220; hind foot, 68.

No. 11704, ♂ — Palate with indication of median spine; skull narrower than *hudsonica* and zygomata approaching *mephitis;* white stripes extending on sides of tail to about ½ its length; end of tail blunt and entirely black.

Total length, 615; tail vertebræ, 185; hind foot, 64.5.

No. 11703, ♂ — Palate evenly rounded, without spine; white stripes extending on tail ⅓ its length; end of tail black.

Total length, 560; tail vertebræ, 174; hind foot, 56.5.

No. 11702, ♂ — Palate without median spine; skull narrower and zygomata approaching *mephitis* more than *avia;* white stripes extending on tail; whole end of tail broadly white.

Total length, 600; tail vertebræ, 215; hind foot, 61.

No. 11701, ♂ — Skull badly broken; zygomata badly broken and absent; white stripes extending on sides of tail; end of tail blunt and entirely black.

Total length, 655; tail vertebræ, 230; hind foot, 74.

No. 11707, ♀ — Skull badly broken; palate without median spine; white stripes extending on sides of tail about ½ its length; tail mixed with long white hairs; end of tail black.

Total length, 675; tail vertebræ, 220; hind foot, 67.5.

No. 11720, ♀ — Skull large but badly broken, palate without median spine; white stripes extending but slightly on base of tail; end of tail black, with a few long white hairs extending from the tip.

Total length, 685; tail vertebræ, 220; hind foot, 70.

No. 11721, ♀ — Palate evenly rounded, without median spine; skull approaching *mephitis;* white stripes short, not reaching the rump; rump entirely black; tail black, with the whole end white for about 4 inches.

Total length, 635; tail vertebræ, 215; hind foot, 69.

No. 18395, ♂ — Galena, Illinois, Skull resembling *avia*, but white stripes of body extending on sides of tail nearly to the end; end of tail black; a small white spot on the lower part of the throat.

Total length, 623; tail vertebræ, 258; hind foot, 75.

On September 6, 1910, an old Skunk with three young, the latter about two thirds grown, were taken by Mr. W. E. Snyder at Beaver Dam, Dodge Co., Wisconsin, and the specimens were sent to me for determination. The skull of the adult approaches *avia*, but has a palatal spine slightly indicated; the tail is black except a few white hairs near the middle; the end of the tail is blunt and entirely black. The young show some slight cranial differences; in two of them a palatal spine is slightly indicated; in the third it is entirely absent. All of the young have the white stripes of the body extending on base of tail and all have the tails terminating with a long white pencil (4 to 5 inches long).

Mephitis hudsonica (RICHARDSON).

NORTHERN SKUNK. HUDSONIAN SKUNK. POLECAT.

Mephitis americana var. *hudsonica* RICHARDSON, Fauna Bor. Amer., I, 1829, p. 55.
Mephitis hudsonica ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 28 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 141 (Wisconsin).
Chincha hudsonica HOWELL, N. Amer. Fauna, No. 20, 1901, p. 24 (Minnesota, etc.).

Type locality — Plains of Saskatchewan.

Distribution — From Lake Michigan west to the Rocky Mountains and northwest through Manitoba to the Great Slave Lake region, in the western portion of its Canadian range nearly reaching the coast.

Description — Typical form: Size large; tail with a blunt brush, the end black without a white pencil; general color black; a narrow white stripe extends from the nose, passing between the eyes to the crown; a large white patch on the back of the neck extending in a white stripe which narrows between the shoulders and divides into two lateral stripes which continue down the back and on sides of tail often nearly to the tip; black hairs of tail white at the base; entire under parts black; skull large; zygomata widely expanded posteriorly; palate without median spine.

Measurements — Total length (male), 26.50 to 29.50 in. (672 to 750 mm.); tail vetebræ, 9.50 to 11 in. (242 to 279 mm.); hind foot, about 3.75 in. (82 mm.). Female: Total length, 22.50 to 26 in. (572 to 660 mm.); tail vertebræ, 9.25 to 10.25 in. (235 to 260 mm.); hind foot, about 3 in. (76 mm.).

The Northern or Hudsonian Skunk is supposed to be the common form throughout the greater portion of Wisconsin. Hollister states that out of 28 Skunks collected near Delavan, Walworth Co., 25 were *hudsonica* and only 3 *avia* (*l. c.*, p. 141). Jackson says all the specimens he examined from various parts of the state proved to be *hudsonica* (*l. c.*, p. 28). While the majority of Wisconsin Skunks may probably

Northern Skunk (*Mephitis hudsonica*).

be referred to this species, many of them, as has already been shown, are not typical and strongly suggest intergradation.

Skunks may be numbered among our best known animals, and, although they have the reputation of being undesirable neighbors, largely on account of their malodorous qualities, they are in reality one of our prettiest mammals. They are naturally inoffensive and are of great practical value to the farmer, as they destroy enormous quantities of grasshoppers, beetles, etc. and they also prey upon and kill large numbers of Mice, Ground Squirrels, and other small mammals. It is true that they occasionally kill chickens and suck eggs when they find a nest, but the harm which they do is as nothing when compared with their value to the agriculturist in ridding his gardens and fields of the various pests which destroy his crops.

Skunks usually make their homes in burrows in the ground, although they are not averse to living under an outbuilding or occasionally in an old hollow stump or log. In very cold weather there is no doubt that they hibernate to a more or less extent, but their sleep cannot be very deep or protracted, for on mild winter days I have often seen their fresh tracks in the snow. Sometimes several Skunks live in a den in winter and it is claimed that four or five are often found together and sometimes as many as ten. It would seem probable that in most cases they are members of one family of the preceding season, although Kennicott states that as many as fifteen have been found in winter lying in one nest.*

The young are born in April or early in May and usually number from 4 to 6, rarely more, although as many as ten in a litter have been recorded. They are very pretty little animals and, as already stated, when taken young and the scent glands removed they make interesting and often affectionate pets.

Regarding the scent glands of these animals I cannot do better than quote my esteemed friend, Dr. C. Hart Merriam, who says:†

"His chief weapon of defence lies in the secretion of a pair of anal glands, that lie on either side of the rectum, and are imbedded in a dense gizzard-like mass of muscle which serves to compress them so forcibly that the contained fluid may be ejected to the distance of four or five metres (approximately 13 to 16½ feet). Each sac is furnished with a single duct that leads into a prominent nipple-like papilla that is capable of being protruded from the anus, and by means of which the direction of the jet is governed. The secretion is a clear, limpid fluid of an amber or golden yellow color, has an intensely acid reaction, and,

* U. S. Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 249.

† Mamm. Adirondack Reg., 1886, pp. 76–78.

in the evening is slightly luminous. On standing in a bottle, a flocculent, whitish precipitate separates and falls to the bottom. The fluid sometimes shows a decided greenish cast, and it always possesses an odor that is characteristic, and in some respects unique. Its all-pervading, penetrating and lasting properties are too well known to require more than passing comment. I have known the scent to become strikingly apparent in every part of a well closed house, in winter, within five minutes after a Skunk had been killed at a distance of a hundred metres (about twenty rods)! The odor generally remains noticeable for weeks and sometimes for months, about the place where one has been killed. The condition of the atmosphere has much to do in determining the matter, for the more humid the air and the higher the temperature, the farther is the scent discernible, and the longer does it last. Under favorable conditions it is certainly distinctly recognizable at a distance of a mile, and DeKay quotes a statement from the Medical Repository that a Dr. Wiley of Rock Island 'distinctly perceived the smell of a Skunk, although the nearest land was twenty miles distant.'

"The scent glands of the Skunk may be removed, bodily, without in any way affecting the health or happiness of the animal. The gizzard-like mass of muscle in which they are imbedded completely surrounds the gut, just at the outlet of the pelvis, and is attached to the tuberosities of the ischium. The chief danger attending the operation is the liability of wounding the rectum, or of creating so much irritation about it that the subsequent inflammation and cicatrization will result in stricture of that important viscus. Care must also be exercised in order to avoid wounding the genito-urinary passages. I have operated, with complete success, both with and without antiseptic precautions. A much simpler operation, where the end in view is merely to disarm the animal, is that performed by Dr. J. M. Warren of Boston, in the year 1849. It consists of making an incision through the skin, directly in front of the anus, and in snipping the ducts of the glands, at the bases of the nipple-like papillæ which project into the gut, just within the sphincter. Adhesive inflammation follows and permanently occludes the ducts at the point of division."

Much has been written about "mad skunks" and the danger of hydrophobia if bitten by them. While there is no doubt that Skunks can contract hydrophobia, in my opinion they rarely do so. I have myself been twice bitten by Skunks and know several people who have been bitten by them, but in no instance was there any after ill effects other than would be produced by any simple wound. Dr. Merriam, who has been bitten several times by Skunks, does not consider their bites more dangerous than any other of our common mammals. Cases

of hydrophobia from the bite of a Skunk have been reported, however, where persons have been bitten with fatal results.* The flesh of young Skunks is very good, as I can testify from personal experience. Dr. Merriam says it " is delicious eating. It is not unlike chicken, but is more delicate and its taste is particularly agreeable" (*l. c.*, p. 76).

Enormous numbers of Skunks are annually trapped and their skins sold for furs which in many cases are offered for sale as "Alaska Sable."

Mephitis mephitis avia (BANGS).

ILLINOIS SKUNK.

Mephitis avia BANGS, Proc. Biol. Soc. Wash., XII, 1898, p. 32.
Mephitis mesomelas avia HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 141 (Wisconsin).

Type locality — San Jose, Mason Co., Illinois.

Distribution — Illinois to southern Wisconsin, eastern Iowa, eastern Missouri and western Indiana; exact limits of range uncertain.

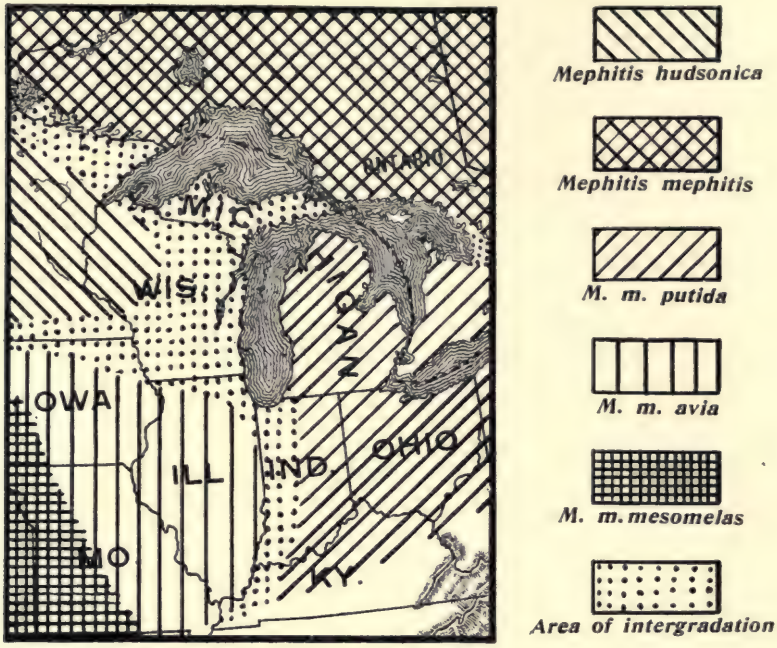
Description — Somewhat smaller than *hudsonica*, pattern of coloration similar, but extent of white marking variable; in some specimens the white stripes end about the middle of the back, in others they continue to the tail; tail usually entirely black, but occasionally with white pencil; zygomata less widely expanded posteriorly than in *hudsonica* and with less abrupt bend than in *hudsonica*. May generally be distinguished from *hudsonica* by somewhat smaller size and shorter tail (tail vertebræ usually less than 9 inches long), shape of zygomata, etc.; and from *putida* by absence of distinct median spine on the palate, no white pencil at end of tail, etc.

Measurements — Total length (male), 25 to 27 in. (625 to 686 mm.); tail vertebræ, 7 to 8.50 in. (175 to 215 mm.); hind foot, about 2.60 in. (65 mm.). Total length (female), 23 to 25.50 in. (580 to 650 mm.); tail vertebræ, 6.25 to 7.25 in. (158 to 184 mm.); hind foot, about 2.50 (62 mm.).

The Illinois Skunk is the common form which occurs throughout Illinois, and it has been recorded from southern Wisconsin; but the limits of its range in the latter state have not been satisfactorily determined. Hollister records 3 specimens from Delavan, identified by Howell (*l. c.*, p. 141), and I have examined a number of Wisconsin Skunks which might be referred to this form; but, as has already been stated† the variation in markings and size of different individuals often

* See Dr. J. S. Janeway, N. Y. Med. Rec., March, 1875; also Coues, Fur Bearing Animals, 1877, p. 229.

† See ante, p. 339.



Map showing supposed distribution of Skunks belonging to the genus *Mephitis* in Illinois and Wisconsin and adjoining states.

Mephitis hudsonica (RICHARDSON). Type locality — Plains of the Saskatchewan, Canada. Size large; total length from 26 to 29 inches; tail with blunt black brush at tip, without white pencil; no median spine on palate; description as previously given.

Mephitis mephitis (SCHREBER). (Säugthiere, III, 1776, p. 444, tab. CXXI.) Type locality — "America." (The name is now restricted to the northern form of the Eastern Skunk.) Palate without median spine; zygomata heavy and not greatly expanded; tail rather short, mixed black and white, the end white.

Mephitis m. avia (BANGS). Type locality — San Jose, Illinois. Description as previously given. Resembles *mesomelas*, but larger; tail more than half the length of body and usually wholly black.

Mephitis m. putida (BOITARD). (Jard. Plantes Paris, Mamm., 1842, p. 147.) Type locality — New Jersey. Palate with distinct median spine; end of tail with white pencil; tail vertebræ less than 11 inches.

Mephitis m. mesomelas (LICHTENSTEIN). (Darst. Säugeth., 1832, text, pl. 45, fig. 2.) Type locality — Louisiana. Palate without median spine; size small; tail usually wholly black; length about 23 inches; tail vertebræ about 9 inches.

Mephitis m. elongata BANGS. (Proc. Bost. Soc. Nat. Hist., XXVI, 1895, p. 531.) Type locality — Micco, Brevard Co., Florida. Size medium; tail long, usual over 11.50 inches, with white pencil; palate with spine; frontal region arched; rostrum broad.

from the same locality is perplexing and many specimens occur, especially in Wisconsin, which appear to be intergrades.

The habits of this form are apparently similar to those of the Northern or Hudsonian Skunk which has already been described.

Genus **SPILOGALE** Gray.

Spilogale Gray, Proc. Zoöl. Soc. Lond., 1865, p. 150. Type *Mephitis interrupta* Rafinesque.

Size smaller than *Mephitis;* skull somewhat flattened; audital bullæ inflated; auditory meatus tubular and directed obliquely forward; zygomata prominently arched, the highest point at the middle; back with four white stripes.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{1-1}{2-2}=34$.

Spilogale putorius (LINN.).

ALLEGHENIAN SPOTTED SKUNK. CIVET CAT.

Viverra putorius LINNÆUS, Syst. Nat., X ed., I, 1758, p. 44.

Spilogale putorius HOWELL, N. Amer. Fauna, No. 26, 1906, p. 15 (Tennessee, etc.). *Ib.*, Proc. Biol. Soc. Wash., XXIII, 1910, p. 32 (Illinois, Kentucky).

Type locality — South Carolina.

Distribution — From Virginia to Georgia in the interior, and westward to eastern Arkansas and Missouri, north to western Kentucky, southern Illinois and southern Indiana; exact western limits of range unknown.

Description — General color black and white; *four* white stripes on the back, which are broken on the lower back and appear as irregular spots or bands; a white patch on the forehead; end of tail white.

Spilogale putorius.

Measurements—Total length, 18.50 to 22 in. (470 to 558 mm.); tail vertebræ, 7.50 to 8.70 in. (190.5 to 220 mm.); hind foot, about 2 in. (46 to 51 mm.).

This species is claimed to occur in southern Illinois. Howell states: "They are reported to be fairly common at Golconda, Illinois;" and Hahn includes it in his mammals of Indiana as occurring in Knox County. Hunters inform me that there are two kinds of Skunks in

southern Illinois, "a large one and a little one." There is little doubt that a Spotted Skunk occurs in the southern portion of the state, but so far as known no collector has actually secured a specimen. It may be readily distinguished from our common Skunks (*Mephitis*) by its smaller size and four white back stripes.

Map illustrating supposed distribution of Skunks belonging to the genus *Spilogale* in eastern United States; the range limits of the various forms are not definitely known.

Spilogale putorius (LINN.). Type locality — South Carolina. Description as previously given.

Spilogale interrupta (RAFINESQUE). (Annals of Nature, I, 1820, p. 3.) Type locality — "Upper Missouri" River. Similar to *putorius*, but with white stripes more broken and white marking less in extent; tail entirely black or with only a few white hairs at tip.

Spilogale ambarvalis BANGS. (Proc. Bost. Soc. Nat. Hist., 1898, p. 222.) Type locality — Oak Lodge, opposite Micco, Brevard Co., Florida. Size small; white marking prominent and tail short. Total length, about 15.75 in. (400 mm.) or less; tail vertebræ less than 6 in. (152 mm.).

Spilogale indianola MERRIAM. (N. Amer. Fauna, No. 4, 1890, p. 10.) Type locality — Indianola, Texas. Body marking similar to *interrupta*, but end of tail white usually for about one-third its length.

Spilogale interrupta (RAFINESQUE), PRAIRIE SPOTTED SKUNK. This species may occur in western Wisconsin, as its range is known to extend to northeastern Iowa and the southeastern border of Minnesota, but so far as known it has not as yet been taken within our limits. It resembles *S. putorius*, but it is a much blacker animal, the white marking being more restricted and the stripes more broken.

Genus **TAXIDEA** Storr.

Taxidea Storr, Prodr. Meth. Mamm., 1780, p. 34. Type *Ursus taxus* Schreber.

Body stout; tail short; fore claws large and long, highly developed for digging; skull noticeably wide across occipital; upper carnassial teeth large; bullæ very large; lamboidal crest greatly developed in adult; sagittal crest small. (For cut of skull see p. 276.)

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{1-1}{2-2}=34$.

Taxidea taxus (SCHREBER).

AMERICAN BADGER.

Ursus taxus SCHREBER, Säugthiere, III, 1778, p. 520.

Meles Labradoria LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois).

Taxidea americana KENNICOTT, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 250 (Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 655 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 183 (Iowa). HOY, Trans. Wis. Acad. Sci. Arts & Lat., V, 1882, p. 256 (Wisconsin). BRAYTON, Rept. Geol. Surv. Ohio, IV, Pt. I, 1882, p. 42 (Kankakee Co., Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 86 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 137 (Indiana). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin).

Taxidea taxus ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 28 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 141 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 577 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 574 (Illinois).

Type locality — Originally given as Labrador and Hudson Bay, although the species is not known to occur there.

Distribution — From northern Indiana west to the Sierra Nevada Mountains, south at least to Kansas and New Mexico, north in the Saskatchewan region to about latitude 55°; replaced in the South and West by allied forms.

Description — General color grizzly gray; head brown, with a patch of white below and behind the ears and a white stripe on middle of crown extending from the nose to the nape; feet and greater portion of legs brownish black, the claws pale, large, often 1.50 inches in length; chin and upper throat dull white, rest of under parts buffy white or yellowish white; tail tinged with yellowish brown.

Measurements — Length, about 27 to 29 in. (691 to 741 mm.); tail vertebræ, about 5 in. (125 to 136 mm.); hind foot, 3.85 in. (95 to 105 mm.).

The Badger still occurs in more or less numbers in various localities throughout Wisconsin and occasionally in the northern two-thirds of Illinois. In the early days it was common. Kennicott (1854) gives it as formerly common in Cook County and states that at that time it was still common farther south (*l. c.*, p. 578). Brayton (1882) mentions a Badger taken in Kankakee County, Illinois, in 1857. Wood says: "It is reported that a specimen was killed a few miles north of Urbana in 1908. The dead animal was seen by reliable persons, but I have been unable to verify the identification by seeing the skin" (*l. c.*, p. 574). In 1909 it was reported by hunters to be not uncommon in Jo Daviess and Stephenson counties, Illinois. Kennicott says: "In Illinois badgers were once numerous at least as far south as the middle of the state; and were seen thirty years ago near the Kaskaskia River. They still exist in De Kalb County" (*l. c.*, 1858, p. 250).

There are numerous records from Wisconsin. I have examined specimens from Rock and Dodge counties and one which was claimed to have been killed near Lake Geneva, Walworth Co., in 1902. Dr. H. V. Ogden of Milwaukee has skulls in his collection from Douglas and Milton counties. Mr. W. E. Snyder has five specimens in his collection taken in Dodge County between 1902 and 1908, and he informs me that at least five others were killed in Dodge County during the summer of 1902. Hollister records it from Delavan, Walworth Co., in 1908 (*l. c.*, p. 141); and Jackson records 10 specimens captured within a radius of 8 miles of Milton, Rock Co., from 1900 to 1902 (*l. c.*, p. 28). I am informed by reliable persons that during the past five years (1906 to 1911) one or more specimens have been taken in Marinette, Florence, Forest, Marathon, Taylor, Iron, Douglas, Rusk, Polk and Buffalo counties.

While the Badger was probably common in portions of Illinois and Wisconsin in early days, it was much more so farther west. Dr. Elliott Coues writes: "I have seen Badgers in countless numbers nearly throughout the region of the upper Missouri River and its tributaries. I do not see how they could well be more numerous anywhere. In

American Badger (*Taxidea taxus*).

some favorite stretches of sandy, sterile soil their burrows are *everywhere*, together with those of Kit Foxes, Prairie Dogs, and Spermophiles, and, as already said, these holes are a source of annoyance and even danger to the traveler. In ordinary journeying, one has to keep constant lookout lest his horse suddenly goes down under him, with a fore leg deep in a Badger hole."*

Map illustrating approximate range of the American Badger, *Taxidea taxus*, in eastern United States and Canada.

Taxidea taxus (SCHREBER). Type locality — Northern North America; originally given as Labrador and Hudson Bay, but the species is not known to occur there. Description as previously given.

Taxidea t. berlandieri (BAIRD). (Mammals N. Amer., 1857, p. 205.) Type locality — Staked plains of Texas (Llano estacado), near border of New Mexico. General coloration less gray and more buffy; white line on back longer, occasionally extending to the tail.

* Fur-bearing Animals, 1877, p. 281.

The Badger is a shy animal, largely nocturnal in its habits, and is rarely seen even in localities where it is common. It is clumsy and slow in its movements and subsists largely upon ground Rodents, such as Prairie Squirrels, Mice, etc., which it digs out with little difficulty, although it also eats insects, snails, honey, young birds and eggs. Its home is a burrow in the ground in dry and preferably sandy soil. Kennicott says its underground habitation is sometimes 6 feet deep and 30 feet in length, but he found others only 2 feet below the surface and but 6 feet in length (*l. c.*, p. 251). All authorities agree that the Badger hibernates in cold weather, at least in the northern part of its range; but the length of its winter sleep apparently depends largely upon the temperature. The young are usually born in May and number from 2 to 5.

Badgers are provided with anal glands secreting a noxious smelling fluid, but our species cannot forceably eject it like the Skunks. The skins of Badgers make very good fur and are much used for robes, as well as muffs and tippets of the cheaper grade. The hair is also used in the manufacture of shaving brushes and artists' materials.

Specimens examined from Illinois and Wisconsin:

Wisconsin — (M. P. M.) Milton, Rock Co., 1; (O. C.) Douglas Co. (skull), 1; Milton, Rock Co. (skull), 1; (S. C.) Dodge Co., 5; (O.) Walworth Co., 1 = 9.

Subfamily MUSTELINÆ. Wolverine, Martens, Minks, Weasels, etc.

Genus **GULO** Storr.

Gulo Storr, Prodr. Meth. Mamm., 1780, p. 34. Type *Mustela gulo* Linn.

Body stout; hair thick and long; claws large and curved; tail short and bushy; ears short; rostrum short; zygomata broadly expanded; bullæ laterally elongated, forming a tubular auditory meatus; upper molar extending inward at right angle with the carnassial; last lower molar small; feet semi-plantigrade.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{4-4}$, M. $\frac{1-1}{2-2} = 34$.

Gulo luscus (LINN.).

WOLVERINE. CARCAJOU. GLUTTON.

[*Ursus*] *luscus* LINNÆUS, Syst. Nat., X ed., I, 1758, p. 47.

Gulo luscus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338. KENNICOTT, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 245 (Wisconsin). MILES, Rept. Geol. Surv. Mich., 1860 (1861), p. 220 (Michigan). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 42 (Iowa). HOY, Trans. Wis. Acad. Sci., Arts & Letters, V, 1882, p. 256 (Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 43 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 131 (Michigan). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 141 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 579 (Indiana).

Gulo Luscus THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 655 (Illinois).

Gulo borealis HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 99 (Minnesota).

Type locality — Hudson Bay

Distribution — Practically the whole of northern North America, south in the eastern portion of its range to about latitude 45° and formerly to the mountains in Pennsylvania.

Description — Largest of the family; general color dark brown, grayish on cheeks and crown; a broad pale stripe extends from the shoulder along the sides of the body to the tail; rump paler than the back, sometimes brownish white; throat and breast with irregular markings of yellowish white; claws pale; sexes similar.

Measurements — Total length, about 36 to 38 in. (940 mm.); tail vertebræ, about 6.50 to 7.50 in. (170 mm.); hind foot, about 7 in. (178 mm.).

There is no reason to question the occurrence of the Wolverine in Wisconsin in early days, especially as it is claimed that straggling individuals have been taken in Indiana, one of them as far south as Knox County (Hahn, *l. c.*, p. 580). Dr. P. R. Hoy says, "Wolverines, *Gulo luscus*, are occasionally taken in the timber; one was taken in La Crosse County, in 1870" (*l. c.*, p. 256). Strong (1883) writes, "Occurs rarely in northern Wisconsin" (*l. c.*, p. 437). Adams in his notes on the mammals of Ontonagon County, Michigan Peninsula, says: "At Rockland five were bought by his brother, J. M. Haring, between 1865 and 1875. This is the only Michigan (?) locality known to the writer. Of course, the animals may not have been killed near Rockland, but may have come from a distance" (*l. c.*, p. 131). Old trappers living in the vicinity of Champion, Michigan, claim that Wolverines were occasionally killed in that locality, 30 or 35 years ago.

Wolverine (*Gulo luscus*).

Mr. Edward G. Kingsford of Iron Mountain, Michigan, a gentleman who is perfectly familiar with this animal, writes me as follows: "From 1880 until 1900 I was in the woods of northern Wisconsin, Michigan and Minnesota nearly all the time, both summer and winter. I have never heard of a Wolverine being killed nearer here than the Rainey Lake District of Minnesota and have never seen the tracks of one here. About 1895 to 1897 they were quite plentiful in northern Minnesota. Trappers complained of their depredations *the same as they did here in the early days*, so it is quite probable that they may have been killed not many years ago in the northwestern part of Wisconsin, as they are great travellers."

The Milwaukee Public Museum collection contains two mounted specimens which may or may not have been actually taken in the state, as they are labeled "Wisconsin," without date or locality.

From its earliest mention by writers in the 16th century, the Wolverine or Glutton, as it was called, has been the subject of the most extraordinary tales and superstitions. Fabulous stories were told of its ferocity, strength and sagacity, which each succeeding writer gravely repeated, usually adding something equally extravagant on his own account. Olaus Magnus (1562) was responsible for one of the most ridiculous fables which seems to have been accepted without comment and apparently endorsed by various writers for two hundred years. According to his account, the Glutton, after feasting upon the carcass of a large animal until its belly was swollen to such an extent it could hold no more, obtained relief by squeezing itself between two trees in order that it might return to glut itself anew.* Topsell considered this absurd story worthy of pictorial illustration and not to be outdone by his predecessors, gravely informs us that when the beast can find no trees growing sufficiently near together to accomplish his purpose, "then taketh he an Alder-tree and with his fore-feete rendeth the same asunder, and passeth through the middest of it for the cause aforesaid."† Other writers allowed their imagination free play in commenting upon its wonderful sagacity. I quote from Dr. Elliott Coues's charmingly written history of this animal. He says: "Still in the track of the marvellous, we read how the Glutton, too clumsy and tardy of foot to overtake large Ruminants, betakes itself to the trees beneath which they may pass, and there crouches in wait for its victim; it drops like

* "Hoc animal voracissimum est, reperto namique cadavere tantum vorat ut violento cibo corpus instar tympani extendatur: inventaque angustia inter arbores se stringit ut violentius egerat: sicque extenuatum revertitur ad cadaver et ad summum usque repletur, iterumque se strigit angustia priore." (Olaus Magnus, Historia de Gentibus Septentrionalibus, 1652, p. 138.)

† Historie of Foure Footed Beastes, London, 1607, p. 262.

a shot upon the unsuspecting Elk, Moose, Reindeer, and fastening with claws and teeth, sucks the blood and destroys them as they run. That nothing may be left undone to ensure success, the animal has the wit to throw down moss or lichens to attract its prey, and to employ the friendly services of Foxes to drive the quarry beneath the fatal spot. I allude to these things, not that such gross exaggerations longer require refutation, but because they are a part, and no inconsiderable one, of the history of the species; and because, as we shall see in the sequel, a perfectly temperate and truthful narration of the creature's actual habits, sufficiently attest the possession of really remarkable qualities, which need be but caricatured for transformation into just such fables."*

To still further enhance this animal's reputation for eccentricity Linnæus bestowed upon it the name *luscus*, which might not unreasonably be supposed to imply that it was a kind of quadruped Cyclops.†

There is no doubt that the Wolverine is an unusually strong, savage and sagacious animal, as has time and again unquestionably been proved. In localities where they are common, hunters find difficulty in making a "cache" of supplies which cannot be found and destroyed by these animals. Dr. Coues cites a case where a Wolverine has been known to gnaw through a log nearly a foot in diameter and also to dig a hole several feet deep in frozen ground to gain access to the coveted supply. The same author also says: "To the trapper, the Wolverines are equally annoying. When they have discovered a line of Marten traps, they will never abandon the road, and must be killed before the trapping can be successfully carried on. Beginning at one end they proceed from trap to trap along the whole line, pulling them successively to pieces, and taking out the baits from behind. When they can eat no more, they continue to steal the baits and cache them. If hungry, they may devour two or three of the Martens they find captured, the remainder being carried off and hidden in the snow at a considerable distance. The work of demolition goes on as fast as the traps can be renewed."

"The propensity to steal and hide things is one of the strongest traits of the Wolverine. To such an extent is it developed that the animal will often secrete articles of no possible use to itself. Besides the wanton destruction of Marten traps, it will carry off the sticks and hide them at a distance, apparently in sheer malice." (*l. c.*, p. 51.)

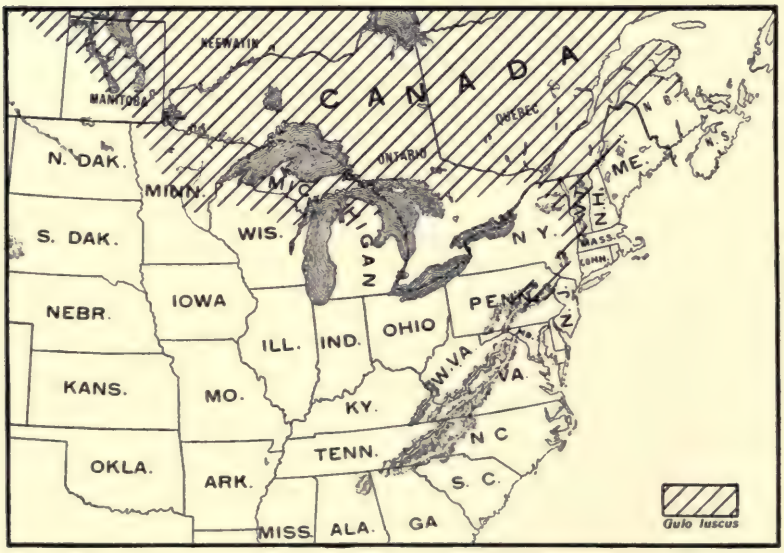
Ross says: "The desire for accumulating property seems so deeply

* Fur-bearing Animals, 1877, p. 44.

† It is far from probable that the great naturalist intended to convey any such meaning, although we have a similar misnomer in that of the Great Bird of Paradise (*P. apoda*) described by the same author and so named for the reason that the first skins of the species received in Europe lacked feet.

implanted in these animals that, like tame ravens, it does not appear to care much what it steals so that it can exercise its favorite propensity to commit mischief. An instance occurred within my own knowledge in which a hunter and his family having left their lodge unguarded during their absence, on their return found it completely gutted—the walls were there but nothing else. Blankets, guns, kettles, axes, cans, knives and all other paraphernalia of a trapper's tent had vanished, and the tracks left by the beast showed who had been the thief. The family set to work, and by carefully following up his paths, recovered, with some trifling exceptions, the whole of the lost property."*

It has generally been supposed by modern naturalists that Wolverines do not attack and kill large mammals, such as the Moose and Elk, although they eat them when they find them dead, but according to Mr. J. Keele of the Canadian Geological Survey this is not always the case. On March 27, 1908, on Third Lake, Ross River (an affluent of the Pelly), he saw a Moose floundering in deep snow and he and his companion shot it and found that it had already been nearly killed by a Wolverine that had leaped on its back from a tree.†



Map illustrating the supposed range of the Wolverine, (*Gulo luscus*) up to the latter part of the last century (about 1870 to 1880). It is very doubtful that the species occurs at the present time in northern Wisconsin or Michigan.

* Canadian Nat. and Geol., VI, 1861, p. 30.

† Forest and Stream, Dec. 19, 1908, p. 971.

Wolverines do not hibernate but wander about in the snow in the coldest weather. Audubon and Bachman tracked one for five miles over snow-covered hills in northern New York.* Mr. Edward G. Kingsford of Iron Mountain, Michigan, who met with this species a number of times in Minnesota, writes:

"I remember chasing one on snow shoes in Minnesota about fifteen miles, thinking that I might catch him as the snow was soft and his short legs seemed to go in full length, but he was going when I quit."

According to various writers the Wolverine makes its den in a hollow in the ground or a natural cave under rocks. The young are born in May or June and usually number from 2 to 4, although, according to MacFarlane, 5 are occasionally found in a litter.†

This species possesses anal glands secreting a rather thick yellowish brown fluid. The odor is extremely noxious, but the fluid cannot be forcibly ejected to a distance.

Genus **PUTORIUS**‡ Cuvier.

Putorius Cuvier, Règne Animal, I, 1817, p. 147. Type *Mustela putorius* Linn.

Body long; tail close-haired or bushy; legs short; carnassial tooth in lower jaw without internal cusp; rostrum short; bullæ flattened. Differs in dentition from genus *Mustela* by having one less premolar on each side of upper and lower jaw.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{1-1}{2-2}=34$.

Two subgenera, which may be characterized as follows, are represented within our limits:

A. Total length generally more than 19.50 inches (size variable); color brown all over, including under parts, except a white spot on chin and usually another on the breast; soles of feet mostly bare; does not turn white in winter.
Subgenus LUTREOLA, MINKS, p. 361.

B. Total length less than 19.50 inches; color brown above, white or yellowish white below; soles of feet mostly covered with hair; turns white in winter in this latitude. Subgenus ICTIS, WEASELS, p. 366.

* Quadrupeds of N. Amer., I, 1846, p. 207.

† Proc. U. S. Nat. Mus., XXVIII, 1905, p. 708.

‡ According to Thomas (Proc. Zoöl. Soc. Lond., 1911, p. 139) the name *Putorius*, commonly used for this genus, must be changed to *Mustela;* and the name *Mustela*, at present used for the Martens, must give place to *Martes*.

KEY TO OUR SPECIES.

GROUP 1. Color brown all over, except usually a white spot on chin and sometimes another on breast; belly not white or yellowish white; animal does not turn white in winter.

Belly brown; tail bushy, darker than the back and blackish at the end; total length of males more than 19 inches; females smaller.

MINK. *Putorius vison lutreocephalus*, p. 361.

GROUP 2. Color (in summer) brown above, most of under parts (including belly) white, yellowish white or yellowish buff; animal turns white in winter in this latitude.

SECTION 1. Total length of males usually more than 13 inches and of females usually more than 11 inches.

Tail about ⅓ or more of total length, black tip of tail long, its beginning not sharply defined; toes and feet generally without white; usually a brown spot back of the angle of the mouth; under parts white, often more or less tinged with lemon yellow. (In winter)* White all over (except black end of tail), more or less tinged with lemon yellow, most pronounced about rump, hind legs and tail.

NEW YORK WEASEL. *Putorius noveboracensis*, p. 366.

Black tip of tail short and abruptly defined; toes and feet with more or less white; under parts washed with ochraceous buff or deep saffron yellow. (In winter) White all over (except black tip of tail), without yellow tinge except at times on tail. MINNESOTA LONG-TAILED WEASEL. *Putorius longicauda spadix*, p. 374.

SECTION 2. Total length of males less than 13 inches and of females less than 11 inches.

Male usually more than 8.50 inches long and female more than 7.50 inches long; tail generally nearer ¼ than ⅓ of the total length. (In summer) Toes and generally inner sides of hind feet usually with tinge of yellow. (In winter) White all over, more or less washed with pale yellow most pronounced on rump, hind feet and tail; end of tail always black.

BONAPARTE'S WEASEL. *Putorius cicognanii*, p. 375.

Males less than 8.25 inches long; females less than 7.50 inches. (In summer) Brown above; under parts white or whitish; end of tail without black tip. (In winter) Pelage entirely white; tail without black tip except occasionally with a few blackish hairs at extreme end.

ALLEGHENIAN LEAST WEASEL. *Putorius rixosus allegheniensis*, p. 378.

* Refers to specimens from Wisconsin and northern Illinois. In the southern part of its range it does not turn white in winter.

Skull of Mink (*Putorius vison*).
(About natural size.)
From Elliot's Synopsis Mammals N. Amer.

Subgenus **LUTREOLA** Wagner.

Color nearly uniform all over; tail bushy; cusps of molars and premolars well developed; sectorial tooth of upper jaw with well-developed anterio-exterior cusp; frontal outline nearly straight, in adult developing sagittal crest; Palmer pads largely bare; toes partly webbed.*

Putorius vison lutreocephalus (HARLAN).

MINK. HARLAN'S MINK.

Mustela lutreocephalus HARLAN, Fauna Americana, 1825, p. 63.

Putorius vison LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., 1853–54 (1855), p. 578 (Cook Co. Illinois). *Ib.*, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 101. MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 118 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 137 (Indiana).

Lutreola vison RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 198 (Tennessee). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 125 (Wisconsin).

Lutreola vison lutreocephalus HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 581 (Indiana).

Putorius lutreolus ALLEN, Proc, Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 183 (Iowa).

Type locality — Maryland.

Distribution — Greater portion of North America, north to about latitude 52°, except in the Southeastern states from Tennessee and North Carolina southward where it is replaced by *P. v. vulgivagus;* and somewhere north of Pennsylvania and east of the Great Lakes where it intergrades with *P. vison.* The limits of its northeastern range have not been definitely determined.

Description — General color nearly uniform umber brown; dorsal area usually darker than the sides; tail dark brown or blackish brown; chin white and usually an irregular white spot on chest; rest of under parts brown occasionally with one or more irregular white patches on belly. Individual specimens vary greatly in size and the females are decidedly smaller than the males, but may always be distinguished from Weasels by the brown belly and more bushy tail.

Measurements — Total length (male), generally from 23.50 to 25 in. (500 to 627 mm.); tail vertebræ, 7 to 8.25 in. (178 to 209 mm.); hind foot, 2.50 to 2.75 in. (63 to 70 mm.).

* Considered a full genus by some authorities.

Mink (*Putorius vison lutreocephalus*).

The Mink is a common species in many localities throughout Illinois and Wisconsin. It is a semi-aquatic animal, being rarely found far from water, and is an expert swimmer and diver. Its food consists largely of fish which it pursues and catches with almost the facility of the Otter; in fact Linnæus applied the name *Lutreola* (Little Otter) to the Old World form. For piscatorial destructiveness our species is at least the peer of its European cousin, as is shown by the statement of Audubon and Bachman, who claim it has been known to catch a trout a foot long.* Notwithstanding its fondness for water, however, it is equally at home on land and, while a large portion of its food consists of aquatic animals, such as fish, frogs and crayfish, it preys upon many land animals as well, and it destroys quantities of Rabbits, Rats, Muskrats, Mice, etc., as well as birds when it can catch them. Like the Weasel the Mink appears to have an especial antipathy to Rats. Dr. C. Hart Merriam says:† "When taken sufficiently young he is easily domesticated, and makes one of the best of 'ratters.' He follows these common pests into their holes, and destroys large numbers of them. The remainder are so terrified that they leave the premises in great haste and are not apt soon to return."

Writing of the habits of the Mink in Illinois, Kennicott says: "Near the prairies of this State, the mink sometimes takes possession of the house of a musk-rat, after devouring or driving off the rightful inhabitants. It appears to be quite as abundant and as much at home about prairie ponds and streams as in the woods. It digs burrows on the dry ground near the water, frequently in old ant-hills, some of which were penetrated to a depth of two or three feet, and a foot or two below the surface of the ground. At the extremity of the burrow is a chamber a foot in diameter, in which is found a globular nest of soft grass, lined with feathers, constructed with considerable art, and entered by an opening on one side. In the northern part of this State, where the climate is more severe, the burrows are deeper, being sometimes eight or ten feet in extent, with the nest two feet below the surface. On the prairie, minks are also found living in burrows, often six or eight rods in length, on high ground, from which long galleries extend to the edge of a slough or pond. These galleries, however, are not formed by the minks, but by musk-rats which dig them in order to place their nests beyond the reach of high water, and yet have subterranean communication with the stream. Though they frequently take possession of the burrows of the musk-rat, and sometimes those of the badger and skunk, when situated in suitable localities, they also excavate them for them-

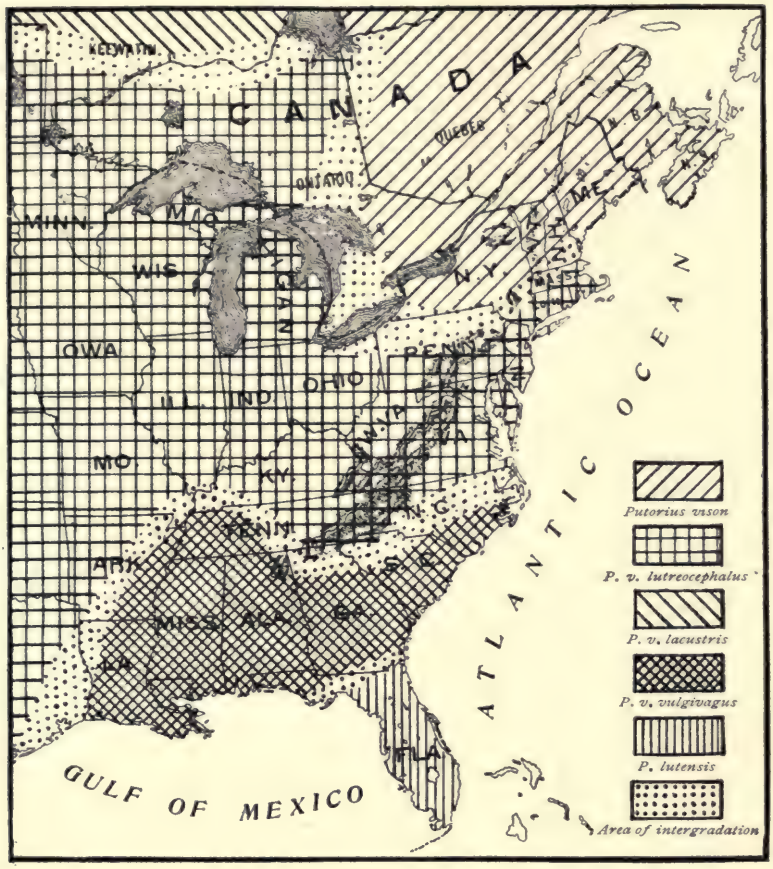
* Quadrupeds of N. Amer., I, 1846, p. 255.

† Mamm. Adirondack Reg., 1886, p. 67.

selves, but of much less diameter. In the woods, the burrows are generally found under logs or the roots of trees near the water, and in rocky regions they burrow under rocks or stone walls; and I have occasionally discovered them living in the hollow of a fallen tree, or in the decayed roots of large trees growing in the water.

"The mink is not at all gregarious, and does not even live in pairs. During the love-season, which occurs in February or March, according to the climate, the female is accompanied by one or more males; but after this, each lives alone, the males apparently wandering about the remainder of the year. The young are brought forth in April or May, usually to a number of five or six, though sometimes there are as few as three. They separate from the mother as soon as they are able to take care of themselves, and before winter each provides itself a residence. The female exhibits considerable affection for her young, and when in danger does not willingly desert them. She carries prey to them for a time before they leave the burrow, as the remains of birds and mammals are often found in the nest. The adults, however, have the habit of conveying their prey to their retreats at all times.

"The mink is strictly carnivorous, and never, to my knowledge, eats vegetables. Besides birds and mammals, it feeds upon fish and aquatic reptiles, but probably does not subsist upon insects to much extent. Though not so expert as the otter, it frequently succeeds in catching fish in shallow water. In the prairie sloughs it devours at times considerable quantities of cray-fish, tadpoles, and frogs; and when the smaller of these places become nearly dry from evaporation, and are quite alive with tadpoles, and occasionally with mud-fish and stickle-backs, in common with the musk-rat, the raccoon, and reptile-eating birds, it clears these muddy pools entirely of their unfortunate inhabitants, which have no way of escape. The mink, however, does not always confine itself to this kind of prey; for when once it has gained access to the farmyard, stocked with young turkeys, chickens, and ducks, it far prefers taking up its residence near by, where, without the exertion of long journeys and hard chases, it can make a nocturnal feast of its favorite food—blood and brains. Though destructive, it is not usually so much so in the poultry-yard as the weasel or skunk; for often, at least, if not generally, it exhibits much moderation, comparatively, contenting itself with a single fowl each night. In pursuing its prey, it follows the track by scent, like a dog, as may frequently be seen in the snow where it is chasing a grey rabbit or a covey of grouse or quails, which, as well as many water-birds, with their eggs and young, it destroys. It also steals upon its prey, and seizes it by a spring, like a cat." (*l. c.*, 1858, pp. 102–103.)



Supposed distribution of the Minks (subgenus *Lutreola*) in eastern United States and Canada. The range limits of the various forms have not as yet been satisfactorily determined.

Putorius vison (SCHREBER). (Säugthiere, III, 1777, p. 463.) Type locality — Eastern Canada. A small, dark form.

Putorius v. lutreocephalus (HARLAN). Type locality — Maryland. Larger and not so dark as *vison*. Description as previously given.

Putorius v. vulgivagus (BANGS). (Proc. Bost. Soc. Nat. Hist., XXVII, 1895, p. 536.) Type locality — Burbridge, Plaquemines Parish, Louisiana. Somewhat paler than *vison;* skull arched and rounded.

Putorius v. lacustris (PREBLE). (N. Amer. Fauna, No. 22, 1902, p. 66.) Type locality — Echemamish River, near Painted Stone, Keewatin, Canada. "Similar to *P. vison* but larger; skull more angular" (Preble); very close to *lutreocephalus.*

Putorius lutensis BANGS. (Proc. Bost. Soc. Nat. Hist., XXIX, 1898, p. 229.) Type locality — Matanzas Inlet, St. John Co., Florida. Size smaller than *lutreocephalus;* tail shorter; general color decidedly paler and less brown.

While the Mink cannot eject the odorous secretion of its anal glands to a distance, as does the Skunk, the liquid is equally offensive. Dr. Elliott Coues says:* "The peculiar odor which the animals of this genus have in common attains in this large and vigorous species a surpassing degree of fetor, though of the same quality. No animal in this country, except the Skunk, possesses so powerful, penetrating and lasting an effluvium. Its strength is fully perceived in taking the animal from a trap, or when the Mink is otherwise irritated. Ordinarily the scent is not emitted to any noticeable degree; it is under voluntary control, and the fact that the Mink spends most of its time in the water is another reason why its proximity, even in numbers, is not commonly perceived by smell. Both sexes possess the scent bags; they lie in the perinæum, one on each side of the rectum, and open upon a papilla on either side of the anus, just within the edge of the external orifice."

Unlike the Weasels, the Mink does not turn white in winter.

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Warsaw, 1; Deerfield, Lake Co., 1 = 2.
Indiana — Evansville, 1.
Michigan — Park Siding, 1.
Wisconsin — (M. P. M.) Wauwatosa, Milwaukee Co., 2; Glidden, Ashland Co., 1; Rock Co., 1; (O. C., skulls only) St. Croix River, Douglas Co., 2; Mercer, Iron Co., 2; Langlade Co., 4; Turtle Lake, Barron Co., 5; Pewaukee, Waukesha Co., 11; Colfax, Dunn Co., 8; Fisher Lake, Iron Co., 1 = 37.

Subgenus **ICTIS** Kaup.

Body long, slender and close haired; upper parts darker than under parts (in summer); soles of feet largely covered with fur.

Putorius noveboracensis EMMONS.

NEW YORK WEASEL. ERMINE.

Putorius noveboracensis EMMONS, Rept. Quadr. Mass., 1840, p. 45. KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 104 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). MERRIAM, N. Amer. Fauna, No. 11, 1896, p. 7. RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 198 (Tennessee). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 125 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 29 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 585 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 65 (Tennessee). *Ib.*, XXIII, 1910, p. 32 (Illinois, Kentucky).

Putorius erminea EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 137 (Indiana).

* Fur-bearing Animals, 1887, pp. 173–174.

Type locality — Southern New York.

Distribution — Eastern United States from southern Maine, northern New York and southern Ontario, Michigan, and greater part of Wisconsin, south to Kentucky, Tennessee and western North Carolina. In the West its range extends at least to the Mississippi River in western Illinois.

Description — *In summer:* Upper parts and fore and hind feet dark brown; generally a brown spot back of the angle of the mouth; under parts white, more or less washed with yellowish (in some northern Illinois specimens the yellowish tinge is absent); terminal portion of the tail black for one third or more of its length. *In winter:* Entire pelage white (except end of tail), more or less washed with yellowish; the yellowish tinge is usually noticeable on under parts and distinctly so about the rump, hind legs and tail; end of tail always black; in the southern portion of its range it does not turn white in winter, but the pelage is paler; size very variable; females much smaller than the males.

Measurements — Total length (males), usually from 14.50 to 16 in. (370 to 416 mm.); tail vertebræ, 4.75 to 5.50 in. (120 to 140 mm.); hind foot, 1.75 in. (44.5 mm.). Total length (females), 12 to 13.50 in. (304 to 342 mm.); tail vertebræ, 4.25 to 4.75 in. (108 to 120 mm.); hind foot, about 1.37 in. (35 mm.).

Remarks — Adult males of this species may readily be distinguished by size, relative length of tail, etc. from *P. cicognanii*, but a female *noveboracensis* and a male *cicognanii* often resemble each other very closely. They may generally be distinguished by the relative difference in the length of tail (see page 360.) and the absence of yellowish white on the inner side of the hind foot.

The range of the New York Weasel includes practically the whole of Illinois* and the greater part of Wisconsin. It is common at least as far north as Marathon County and there is a specimen in the Milwaukee Public Museum from Oconto County, Wisconsin. Howell gives it as fairly common in southern Illinois and records specimens from Golconda, Pope Co., and Lick Creek, Union Co. (*l. c.*, p. 32).

Although Weasels are the smallest of our carnivorous species, they are the most ferocious and sanguinary of them all. They seem to

* This species in the southern part of its range is claimed to have the under parts decidedly pale yellow and does not turn white in winter; while in the northern portion of its range it turns white in winter and has the under parts white in summer. Mr. Bangs has separated them subspecifically, naming the yellow-bellied form *notius*. Both white and yellow-bellied specimens are found in northern Illinois and the animal turns white in winter in this latitude. If the subspecies stands the test of time, it is probable that *notius* may be found to occur in southern Illinois, but a lack of specimens for comparison prevents me from deciding this question.

Male. New York Weasel (Summer pelage) (*Putorius noveboracensis.*) Female.

delight in killing, and hunger plays but little part in their war of extermination. Probably no other mammal, with the possible exception of man, is so wanton in taking life and habitually destroying, for the mere lust of killing, far more than it can possibly eat.

Audubon and Bachman inform us that they have known "forty well grown fowls to have been killed in one night by a single Ermine;"* Dr. Merriam states he has lost fifteen doves in a single night killed by one Weasel, and I personally know of several instances where farmers have lost a dozen or more chickens in a night from the depredations of these animals. Where they can secure food with little effort they rarely eat the flesh of their victims; but merely suck the blood and eat the brains of the first few which they kill and the rest of the bodies are left untouched.

Despite the fact that Weasels are undesirable neighbors in the vicinity of poultry yards, it should be borne in mind that their natural food consists largely of Mice and Rats, and by their destruction of great numbers of these pests they probably save the farmer more than the value of the poultry which they occasionally kill. Robert Kennicott, who has given us so much valuable information concerning the habits of our mammals, says: "Fortunately, however, this animal, even when abundant, does not enter the farm-yard so frequently as might be expected, appearing to prefer a free life in the woods to easy but dangerous feasts on domestic fowls. It is generally less apt than the mink to make excursions about the abodes of man. I have observed for several years the presence of a number of these weasels in a grove near a farm-yard well stocked with poultry, which they never appeared to enter, though repeatedly visited by minks and skunks. Indeed, I am inclined to think that, notwithstanding their occasional predatory inroads, they should not be killed when living permanently about meadows or cultivated fields, at a distance from the poultry; for they are not less destructive to many of the farmer's enemies in the fields. Meadow-mice are certainly the greatest pests among mammals of Northern Illinois; and of these the weasel destroys great numbers. I am informed that, upon the appearance of a weasel in the field, the army of mice of all kinds begins a precipitate retreat. A gentleman of Wisconsin related to me that, while following a plough, in spring, he noticed a weasel with a mouse in its mouth, running past him. It entered a hollow log. He determined to watch further, if possible, the animal's movements, and presently saw it come out again, hunt about the roots of some stumps, dead trees, and log-heaps, and then enter a hole, from which a mouse ran out. But the weasel had caught one

* Quadrupeds of N. Amer., II, 1851, p. 58.

and carried it to the nest. Upon cutting open this log, five young weasels were found, and the remains of a large number of mice, doubtless conveyed there as food. Pleased to learn that his supposed enemy was in fact a friend, and his poultry being at considerable distance, the farmer spared the young ones, intending to continue his observations; but upon examination the next morning, they had disappeared, having probably been carried by the mother to a more secure retreat. I have frequently found the half-eaten remains of meadow-mice in their own burrows, or under corn-stacks, which had doubtless been destroyed by this weasel, or perhaps the smaller one (*Putorius cicognanii*). It is surprising that an animal so large as this should be able to force its way into the burrow of meadow-mice; and yet it appears to do so without difficulty.

"Stacks and barnfuls of grain are often over-run with rats and mice; but let a weasel take up his residence there, and soon the pests will disappear. A weasel will, occasionally, remain for some time in a barn, feeding on these vermin, without disturbing the fowls. But it is never safe to trust one near the poultry-yard, for, when once an attack is made, there is no limit to the destruction. When the animal has entered stacks or barns, it has the curious habit of collecting in a particular place the bodies of all the rats and mice it has slain; thus, sometimes, a pile of a hundred or more of their victims may be seen which have been killed in the course of two or three nights.

"The weasel preys largely upon the grey rabbit, pursuing it to its hole, and killing it there. Like the mink, too, it tracks its prey by the scent, so that the rabbit is lost if once he seeks refuge in a burrow or hollow tree. It also captures many ground-squirrels by following them into their holes, and frequently succeeds in killing quails, and sometimes birds as large as the grouse. Insects are doubtless its principal food. Numerous experiments are said to have proved that this species can be used in the manner of the European ferret for driving rabbits from their haunts; and it is probable that it would be found serviceable in a state of domestication for destroying rats and mice. It is readily tamed and kept, making pleasant as well as useful pets when due care is exercised to prevent its attacking poultry. It would probably soon free houses of the troublesome Norway rat, as it could pass through every hole entered thereby.

"Like all the family, the weasel is nocturnal, though in some instances it is seen hunting by day. It is very active, and one may sometimes be tracked in the snow through a journey of two or three miles, made in a single night. It is, however, more attached to a permanent residence than the mink. It is not at all aquatic, nor does it,

to my knowledge, show any preference for the vicinity of water either to its hunting grounds or its retreat. It appears generally to prefer hilly and rocky regions. It is said not to burrow readily, but usually to take possession of the burrow of another animal, or to choose its retreat in some natural crevice among rocks, or in slight excavations formed by itself under trees. I have generally found it occupying the burrow of the common ground-squirrel (*Tamias striatus*), and have sometimes known it to live in hollow logs in summer. It often travels under snow, through pathways constructed like those of the shrews and meadow-mice; and I have traced these snow-covered ways for many rods, where the weasel had evidently been in search of prey. Some of these had been travelled repeatedly and for a long time, though few tracks were seen on the surface. In consequence of this habit, the presence of the animal is sometimes not noticed.

"In its winter quarters, the weasel forms a large, warm nest, like that of the mink. Five young are commonly produced in the early part of summer; and these, I am informed, remain with the mother, or at least keep together in the same neighborhood till autumn, when they separate, and, like the mink, lead a solitary life, the males only joining the females in the pairing season. This is in the latter part of February, at which time the males are very active, wandering far from their burrows in search of the females. I cannot say whether this species ever inhabits the prairie at a distance from the woods. It may be that all the weasels found living on the prairies of Illinois are of the smaller species, *Putorius cicognanii*. All the weasels identified with the *Putorius noveboracensis*, which I have observed, were taken in the woods. This species is not a tree-climber any more than the mink; but it has occasionally been seen to ascend trees, and I am informed of a remarkable instance in which one was observed to pursue and overtake a ground-squirrel upon a tree." (*l. c.*, 1858, pp. 105–106.)

As illustrating the ferocity of these animals, Dr. C. Hart Merriam says:*

"I once put a very large rat into a square tin cage with a Weasel of this species. The rat had been caught in a steel trap by the toes of one of its hind feet, and was in no way injured. He was very ugly, biting fiercely at the trap and the stick with which I assisted him into the cage with the Weasel. No sooner had he entered the cage than his whole manner and bearing changed. He immediately assumed an attitude of abject terror, trembling from head to foot, and crawled into the nearest corner. The Weasel advanced toward him at once, and as he did so the rat raised on his hind legs, letting his fore paws hang

* Mamm. Adirondack Reg., 1886, p. 57.

New York Weasel (Winter pelage). (*Putorius noveboracensis.*)

helplessly over his breast, and squealed piteously. Not only did he show no disposition to fight, but offered no resistance whatever, and did not even attempt to defend himself when molested. The Weasel did not seize him at first, but cuffed him with his fore paws and drove him from one corner of the cage to another, glaring at him continuously. Then, with a sudden move, he sprang upon his victim, already paralyzed with fear, laid open the back of his head with a single bite, ate the brains, and left the quivering carcass untouched.

"The Ermine hunts both by day and by night, and climbs trees with great ease and celerity. I have often 'treed' them myself by running after them in the woods, and have also seen them chase chipmunks up trees. Twice have I seen them run up the smooth trunks of the beech. They are not very timid and will allow a near approach before taking fright."

The New York Weasel turns white in winter in latitudes where there is snow the greater part of the season. The young are born late in April or early in May and usually number from five to eight. Mr. W. E. Snyder informs me that on May 4, 1910, while plowing a field at Beaver Dam, Wisconsin, a Weasel's nest was discovered which presumably belonged to this species. The nest was in a deserted burrow of a Striped Prairie Squirrel (*C. tridecemlineatus*), which was about five feet in length and about a foot below the surface of the ground. The nest was lined with *Microtus* fur and contained eight young Weasels with eyes not yet opened and bodies almost naked except about the shoulders where they were covered with long hair. In the nest were four dead Meadow Mice (*Microtus*), one adult and three young which were evidently intended as a food supply for the mother.

The white winter skins of these animals when used for capes, muffs, etc., are apparently indistinguishable from those of the Old World Weasels (*P. ermina*), which are the Ermine of commerce, often much in fashion for ladies' winter garments, and which in Europe were used for the robes of kings and nobles, thus obtaining a distinct recognition in heraldry.

Like the Minks the Weasels are supplied with anal glands which secrete a fetid liquid, but are unable to forcibly eject it like the Skunk.

Specimens examined from Illinois and Wisconsin:

Illinois — Bloomingdale Springs, 1; Milton Spring, 1; Fort Sheridan, 1; Camp Logan, 3 = 6.

Wisconsin — (M. P. M.) Milton, Rock Co., 2; Milwaukee, 2; Kelly Brook, Oconto Co., 1; Milwaukee Co., 1; (S. C.) Beaver Dam, Dodge Co., 20 = 26.

Map illustrating the supposed range of the New York Weasel (*Putorius noveboracensis*) in eastern United States.

Putorius longicauda spadix BANGS.

MINNESOTA LONG-TAILED WEASEL.

Putorius longicauda spadix BANGS, Proc. Biol. Soc. Wash., X, 1896, p. 8. MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 44 (Ontario).

Type locality — Fort Snelling, Minnesota.

Distribution — Minnesota and western Wisconsin; limits of range not known. Probably intergrades with *P. longicauda* in western Minnesota or eastern Dakota.

Description — *In summer:* Upper parts brown, approaching the color of *P. noveboracensis*; under parts whitish tinged with pale saffron buff (quite different from the lemon yellow wash of *noveboracensis*); greater portion of fore and hind feet whitish like the under parts; chin and upper lip white; tail long, the black tip short, being less than one fourth length of tail; skull somewhat heavier and zygomata more widely expanded than in *noveboracensis*.

In winter: White all over, without yellow tinge; end of tail black; some specimens occasionally show a slight yellowish wash on the tail.

Measurements — Total length (male), about 18 in. (455 mm.); tail vertebræ, about 6.50 in. (164 mm.); hind foot, 2.15 in. (55 mm.). Female smaller; average length about 15 in. (380 mm.); tail, about 5 in. (125 mm.).

There are two specimens in the collection of the Milwaukee Public Museum (one in winter and the other in summer pelage) from Prescott, Pierce County, Wisconsin, which I have provisionally referred to this subspecies. In the coloration of the under parts in summer pelage they resemble *spadix*, but they are by no means typical and the cranial characters and comparative length of the tail strongly suggest intergradation. Unfortunately very few Wisconsin specimens are available for examination and I have seen but two examples in summer pelage. When a good series of Weasels can be secured from northern Wisconsin it is not unlikely that the range of *P. n. occisor* may be found to extend into that region.

Putorius cicognanii (BONAPARTE).

BONAPARTE'S WEASEL.

Mustela cicognanii BONAPARTE, Inconogr. Fauna Ital., I, fasc. XXII, 1838, p. 4.
Putorius cicognanii MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 125 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 28 (Wisconsin).

Type locality — Northeastern North America; exact locality unknown.

Distribution — Northern United States and southern Canada, in the East south to Wisconsin and Michigan and in the mountains of Pennsylvania; in the West its range extends in Canada to the Pacific Coast and in the United States in the Rocky Mountains at least to Colorado.

Special characters — Smaller than *noveboracensis* and tail shorter. In summer the whitish portion of inner sides of hind feet usually more or less tinged with yellow.

Description — *In summer:* Upper parts and legs dark brown; under parts generally including the upper lip, white, more or less washed with yellowish; toes whitish; inner sides of hind feet whitish, more or less tinged with yellow; end of tail black; no brown spot back of angle of mouth.

In winter: Entire pelage, except end of tail, white, washed with yellowish on rump and under parts; end of tail black. The size is variable and the female is much smaller than the male.

Measurements — Total length (males), generally 10.25 to 12 in. (260 to 304 mm.); tail vertebræ, 3.50 to 4.25 in. (88 to 108 mm.); hind foot, about 1.37 in. (35 mm.). Total length (females), 8.50 to 9.50 in. (215 to 241 mm.); tail vertebræ, 2.75 to 3.25 in. (70 to 82.5 mm.); hind foot, about 1.25 in. (32 mm.).

Remarks — While females of this species often resemble males of *noveboracensis* in size, they may generally be distinguished by the relative difference in length of tail (see key, p. 360.) and in summer pelage by the whitish color on toes and often on inner side of the hind foot.

Bonaparte's Weasel (Summer pelage).
(*Putorius cicognanii.*)

Bonaparte's Weasel, sometimes called Short-tailed Weasel, is found in more or less numbers throughout nearly the whole of Wisconsin. It is common in the central and northern parts of the state, but scarce in the extreme southeastern portion, and so far as known it has not been recorded from southwestern Wisconsin or Illinois. Kennicott states that he secured specimens of this species in northern Illinois (presumably Northfield), one of which was sent to the Smithsonian Institution.* This specimen (No. 268, marked R. Kennicott, N. Illinois) has been examined by Mr. N. Hollister who writes: "Mr. Gerrit S. Miller and

* Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 244.

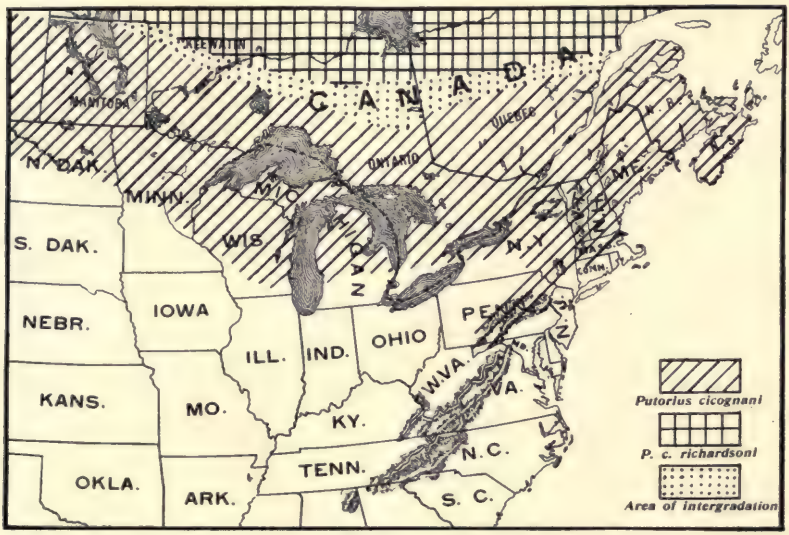
myself have examined the Kennicott Weasel from northern Illinois, and agree that it is an immature *noveboracensis* and not *cicognanii*."

The habits of this species are practically the same as those of the New York Weasel.

Specimens examined from Illinois, Wisconsin and adjoining states:

Wisconsin — Tomahawk Lake, 1; (M. P. M.) Eagle River, Vilas Co., 1; (O. C.) St. Croix River, Douglas Co., 1; Racine Co., 2; Mercer, Iron Co., 4; Fox Lake, Iron Co. (skull), 1; Langlade Co. (skulls), 3; Colfax, Dunn Co. (skulls), 6; Fisher Lake, Iron Co., 2; (S. C.) Beaver Dam, Dodge Co., 2 = 23.

Minnesota — Ft. Snelling, 1; Aitken, 12 = 13.



Map illustrating supposed range of Bonaparte's Weasel (*Putorius cicognanii*) and the southern portion of the range of Richardson's Weasel (*P. c. richardsoni*) in eastern North America.

Putorius cicognanii (BONAP.). Type locality — Northeastern North America. Description as previously given.

Putorius c. richardsoni (BONAP.). (Charlesw. Mag. Nat. Hist., II, 1838, p. 38.) Type locality — Fort Franklin, Great Bear Lake, British Columbia. Similar to *cicognanii* but larger; audital bullæ larger.

Putorius rixosus allegheniensis (RHOADS).

ALLEGHENIAN LEAST WEASEL.

Putorius allegheniensis RHOADS, Proc. Acad. Nat. Sci. Phila., 1900, p. 751.

Putorius rixosus allegheniensis WARD, Bull. Wis. Nat. Hist. Soc., V, 1907, p. 63 (Wisconsin). *Ib.*, VII, 1909, p. 11 (Wisconsin). *Ib.*, IX, 1911, p. 82 (Wisconsin).

Putorius pusillus KENNICOTT, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 245 (northern Illinois and Indiana).

Mustela pusilla LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338.*

Type locality — Near Beallsville, Washington County, Pennsylvania.

Distribution — From Virginia and New York west to Wisconsin; exact limits of range unknown.

Special characters — Size very small; end of tail without black or occasionally slightly dusky at extreme tip. Differs from *P. rixosus* in being somewhat larger and darker, together with some slight cranial differences.

Description — *In summer:* Upper parts walnut brown; under parts white; tail like the back, without distinct black end, although it is occasionally dusky at the extreme tip.

In winter: Entirely white, including end of tail; female decidedly smaller than the male.

Measurements — Total length (male), about 7.50 inches; tail vertebræ, about 1.20 inches; hind foot, about .80 inch.

Male (mounted specimen) — Sauk Co., Wisconsin; total length, 169 mm.; tail vertebræ, 35 mm. (Ward).

Female (in flesh) — Racine Co., Wisconsin; total length, 179 mm.; tail vertebræ, 29; hind foot, 21 (Ward).

Type (mounted specimen) — Total length, 199 mm.; tail vertebræ, 19; hind foot, 20 (Rhoads).

So far as known only four specimens of this little Weasel have been taken within our limits and all of them in Wisconsin. The records for these specimens were first reported by Mr. Henry L. Ward and are as follows: A female from Burlington, Racine Co., Nov. 26, 1906, caught in the country in the act of killing a Mole (*l. c.*, 1907, p. 63); a female captured alive in the town of Sumpter, Sauk Co., Nov., 1902; a male taken January 10, 1906, in the town of Merrimac, Sauk Co. (*l. c.*, 1909, pp. 11–12); and the fourth specimen, which is a female, is in the Milwaukee Museum collection, and was taken near Prescott, Pierce Co., March 6, 1911.

The type of this subspecies was taken near Beallsville, Pennsylvania,

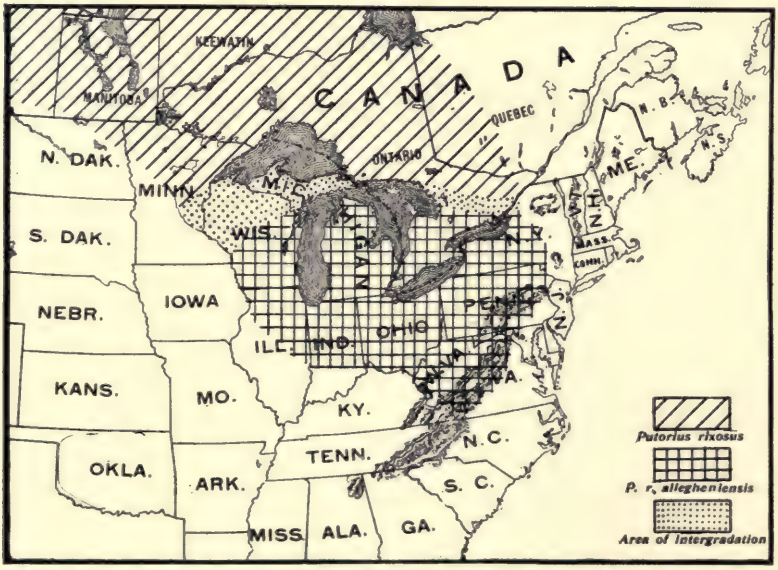
* It is doubtful whether Lapham refers to this species or to some other.

and it will, therefore, undoubtedly be found to occur in northern Illinois and Indiana. I can see no reason why the Lesser Weasel, *P. pusillus*, given by Kennicott as occurring in Indiana and northern Illinois should not be this form. He gives the length from nose to root of tail as about six inches and tail vertebræ not exceeding two inches, and says: "There can be no difficulty in distinguishing it from all others, not only by its dimensions, but by the very short tail, which is destitute of the black tip characteristic of the rest, although the extremity is sometimes dusky" (*l. c.*, p. 245).

Very little is known regarding the habits of this little Weasel, but they probably do not differ from others of this tribe. On account of its diminutive size, however, it would probably not be very destructive to poultry and no doubt preys largely upon small animals, such as Mice, insects and small birds, as does its diminutive European cousin.

Specimens examined from Wisconsin:

Wisconsin — (M. P. M.) Sumpter, Sauk Co., 1; Merrimac, Sauk Co., 1; Prescott, Pierce Co., 1 = 3.



Map illustrating the supposed distribution of the Least Weasels (*Putorius rixosus* and *P. r. allegheniensis*) in eastern United States and Canada. The two forms probably intergrade in eastern Minnesota.

Putorius rixosus Bangs. (Proc. Biol. Soc. Wash., X, 1896, p. 21.) Type locality — Osler, Saskatchewan, Canada. Size very small, smallest of our Weasels.

Putorius r. allegheniensis Rhoads. Type locality — Near Beallsville, Washington Co., Penn. Larger than *rixosus;* description as previously given.

Map showing the type localities of species and subspecies of Weasels (belonging to the subgenus *Ictis*) in eastern United States.

Putorius noveboracensis EMMONS. Type locality — Southern New York. Description as previously given.

Putorius n. notius BANGS. (Proc. N. Eng. Zoöl. Club, I, 1899, p. 53.) Type locality — Weaverville, Buncombe Co., North Carolina. Similar to *noveboracensis* "but darker brown above and yellowish instead of white below; black occupying nearly half the length of the tail" (Bangs).

Putorius n. occisor (BANGS). (Proc. N. Eng. Zoöl. Club, I, 1899, p. 54.) Type locality — Bucksport, near mouth of the Penobscott River, Hancock Co., Maine. Similar to *noveboracensis*, but larger and with longer tail, with less black at the end.

Putorius cicognanii (BONAPARTE). Type locality — Northeastern North America; precise locality unknown. Description as previously given.

Putorius peninsulæ RHOADS. (Proc. Acad. Nat. Sci. Phila., 1894, p. 152.) Type locality — Hudson's, Pasco Co., 14 miles north of Tarpon Springs, Hillsboro Co., Florida. "Size rather large, about equalling male of *Putorius noveboracensis;* skull similar to that of *longicauda*, but with very large audital bullæ" (Rhoads).

Putorius rixosus allegheniensis (RHOADS). Type locality — Beallsville, Washington Co., Pennsylvania. Description as previously given.

Putorius longicauda spadix BANGS. (Proc. Biol. Soc. Wash., X, 1896, p. 8.) Type locality — Fort Snelling, Hennepin Co., Minnesota. Similar to *longicauda*, but darker in summer. Average length of males about 18 inches; tail vertebræ about 6.50 inches; upper parts somewhat more walnut brown than *noveboracensis* in summer, and lacking saffron yellow wash on rump and base of tail in winter; tail decidedly longer; feet whitish.

Genus **MUSTELA** * Linn.

Mustela Linnæus, Syst. Nat., X ed., I, 1758, p. 45. Type *Mustela martes* Linn.

Body long and thickly furred; tail bushy; feet digitigrade; soles of feet furred, with naked pads; lower carnassial or sectorial tooth with small internal tubercle on largest cusp; 5 upper cheek teeth (molars and premolars) and 6 lower in each side of jaws (the Minks and Weasels have less); skull flattened; bullæ flattened; auditory meatus somewhat tubular.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{4-4}$, M. $\frac{1-1}{2-2}=38$.

KEY TO THE SPECIES.

A. Total length less than 30 inches; tail vertebræ less than 10 inches; ears pointed. MARTEN. *Mustela americana*, p. 381.

B. Total length more than 30 inches; tail vertebræ more than 10 inches; ears rounded. FISHER. *Mustela pennanti*, p. 387.

Mustela americana TURTON.

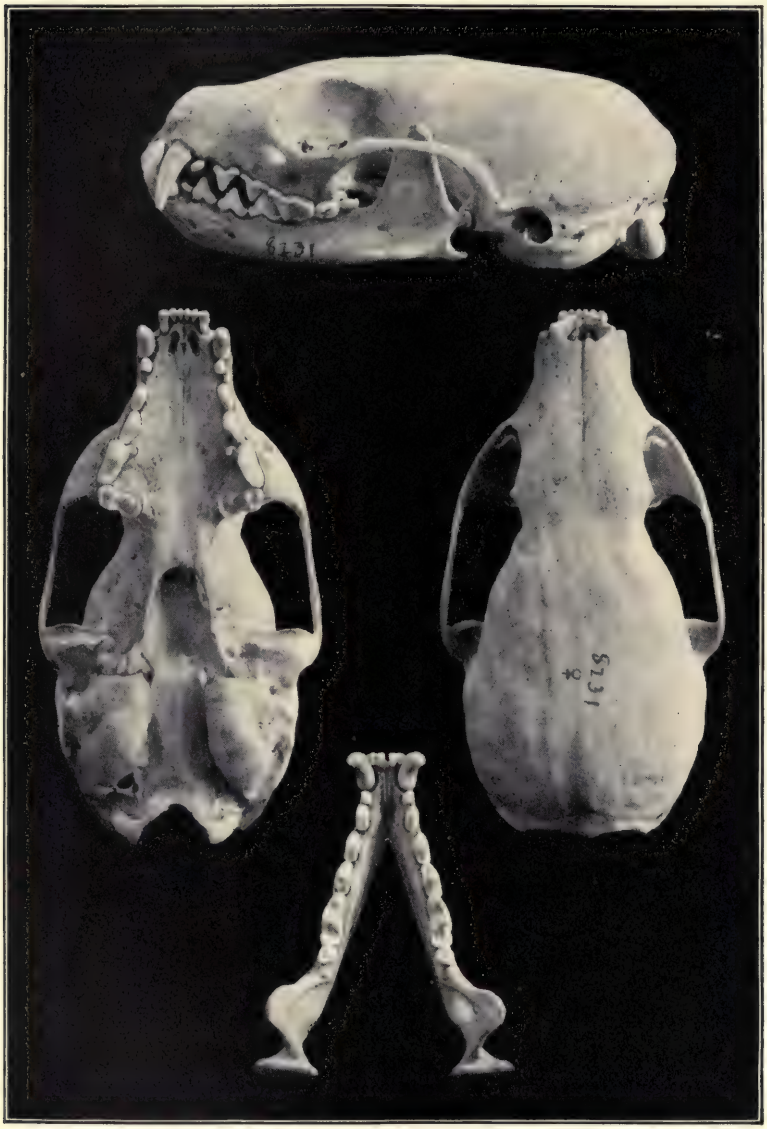
MARTEN. PINE MARTEN. AMERICAN SABLE.

[*Mustela*] *americanus* TURTON, Linnæus System of Nature, I, 1806, p. 60.

Mustela martes LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., 1853–54 (1855), p. 578 (Cook Co., Illinois).

Mustela americana KENNICOTT, Agr. Rept. for 1858, U. S. Pat. Office Rept., 1859, p. 242 (Illinois). THOMAS, Trans. Ill. State Agr. Soc., 1859–60 (1861), p. 654 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 436 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 104 (Minnesota). MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 42 (Nepigon, Ontario).

* According to Thomas (Proc. Zoöl. Soc. Lond., 1911, p. 139) the name *Mustela* commonly used for this genus must give place to *Martes*.



Skull of Marten (*Mustela americana*).
(Slightly reduced.)
From Elliot's Synopsis Mammals N. Amer.

Type locality — Eastern North America.

Distribution — Northeastern North America from Wisconsin, Michigan and New York north to about the latitude of Hudson Bay, west to Minnesota, south in mountains to Virginia; replaced in the West and North by allied forms.

Description — Ears rather high and pointed; general color dark yellowish brown, darkest on middle of back and shading into dusky on the legs and tail; head tinged with gray; a patch of orange buff on throat and breast; claws brownish white. This species varies in color, the brown being lighter or darker in different individuals; the throat patch varies from orange to yellowish white.

Measurements — Total length, about 25 in. (627 mm.); tail vertebræ, about 7.75 in. (197 mm.); hind foot, about 3.50 in. (89 mm.).

While the Marten is steadily decreasing in numbers and is, at the present time, a comparatively rare animal within our limits, a few are still to be found in northern Wisconsin. In former days its range extended considerably farther south. Kennicott records it in his mammals of Cook Co., Illinois, and there is a skeleton in the Chicago Academy of Sciences which is said to have been taken in northern Illinois many years ago. Wisconsin records are as follows: The Field Museum collection contains a specimen from Florence County, and a skull from Star Lake, Vilas Co.; Dr. H. V. Ogden of Milwaukee has skulls in his collection from Fisher Lake, Iron Co., and Drummond, Bayfield Co. The following gentlemen have informed me that Martens are still to be found in the counties of northern Wisconsin named below, their statements being based upon personal knowledge or the testimony of reliable hunters and trappers in their locality: Marinette Co. (Mr. Geo. A. Williams, Kremlin); Florence Co. (Mr. J. E. Parry, Florence); Price Co.* (Mr. W. J. Webster, Park Falls); Iron Co. (Mr. Edward Ball, Sandrock); Bayfield Co. (Mr. M. Berg, Cable); Douglas Co. (Mr. N. Lucins, Jr., Solon Springs, and Mr. G. W. Zeon, Foxboro); Marathon Co. (Mr. Geo. F. Erzwein, Athens).

The Marten is an inhabitant of the forests and, like the Fisher, is an expert climber and largely arboreal in its habits. It preys upon almost any animal that comes in its way, from Hares to Mice, as well as fish, frogs, birds, bird's eggs and carrion. Regarding its habits Robert Kennicott says: " . . . the retreat of the martens is usually in standing hollow trees, and that, in winter, they may frequently be discovered sitting with their heads out of the holes. As, if shot in this position, they would fall back and be lost, advantage is

* Mr. Webster, who is superintendent of schools, writes me that quite a number of Martens have been taken in Price County.

Marten *Mustela americana*).

taken of their inquisitiveness, by walking slowly around the tree, and inducing the animal to draw its body entirely out of the hole, in order to keep the object of its curiosity in view. When quite out, a well-directed shot brings it to the ground.

"The marten prefers the densest woods in mountainous districts, and exhibits no liking for water. It is said that in the far North it preys on mice, hares, and grouse, and in summer on small birds, eggs, etc., and that it does not reject carrion. Like the fisher, it is often troublesome in winter by destroying the hoards of meat and fish laid up by the natives, whenever a crevice is accidentally left by which it can enter. It is stated that it also feeds upon insects and reptiles, and, like the bear, is fond of honey. It is also affirmed that it has been known to eat nuts and berries; but there is doubt, at least, if it ever subsists habitually on any other than animal food. It feeds much upon squirrels, which it pursues and captures on the trees, following them into their holes." (*l. c.*, p. 243.)

Mr. Gerrit S. Miller, Jr., writes: "At Nepigon a trapper told me that martens, wherever they occur in sufficient numbers, so terrorize the red squirrels by constant persecution that the noisy rodents, learning that silence is their best protection, stop chattering. Hence an abundance of silent squirrels is — according to my informant at least — a certain indication that marten fur is plenty" (*l. c.*, p. 42).

It is claimed that Martens are both nocturnal and diurnal in habits. The nest is usually in a hollow tree, but occasionally a burrow in the ground. The young are born late in April or early in May and number from 1 to 5, usually 3 or 4. The odoriferous anal glands of this animal are analogous to those of the weasels.

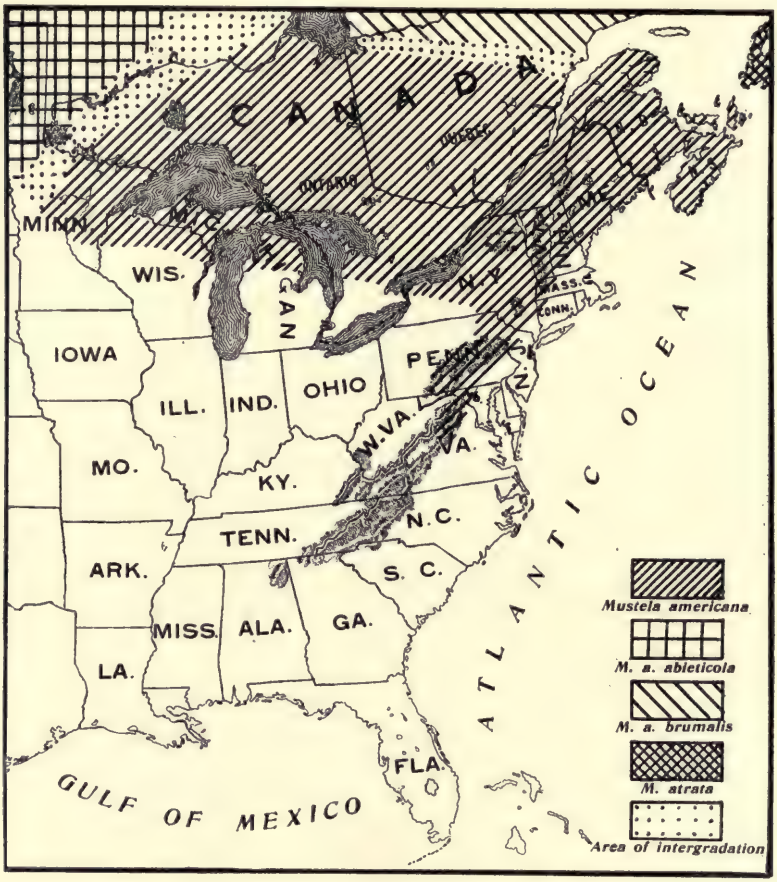
Great numbers of Martens are annually trapped for their skins. The fur is handsome and valuable and is popularly known as American Sable.

All Sables are Martens of some species and furriers have various trade names of their own to indicate shades of color. The most valuable fur furnished by a member of this group of mammals is that of the Asiatic Sable (*Mustela zibellina*), and the finest skins come from Kamchatka and Russian Poland.

Specimens examined from Illinois and Wisconsin:

Wisconsin — Florence Co., 1; Star Lake, Vilas Co. (skull), 1; (O. C.) Fisher Lake, Iron Co. (skull), 1; Drummond, Bayfield Co. (skull), 1 = 4.

"Illinois" — Skeleton, 1. (In Chicago Academy of Sciences.)



Map illustrating supposed distribution of species belonging to the genus *Mustela* (except *M. pennanti*) in eastern United States and Canada.

Mustela americana TURTON. Type locality — Eastern North America. Description as previously given.

Mustela a. abieticola PREBLE. (N. Amer. Fauna, No. 22, 1902, p. 68.) Type locality — Cumberland House, Saskatchewan, Canada. "Much larger than *Mustela americana;* dentition heavier" (Preble).

Mustela a. brumalis (BANGS). (Amer. Nat., XXXII, 1898, p. 502, fig. ——.) Type locality — Okak, Labrador. Larger and darker than *americana.*

Mustela atrata BANGS. (Amer. Nat., XXXI, 1897, p. 162.) Type locality — Bay St. George, New Foundland. Decidedly darker brown and throat patch tinged with orange.

Mustela pennanti ERXLEBEN.

FISHER. PEKÀN. PENNANT'S MARTEN.

[*Mustela*] *pennanti* ERXLEBEN, Syst. Regni Anim., I, 1777, p. 470.

Mustela Canadensis LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin?). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois).

Mustela pennantii KENNICOTT, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 241 (northern Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 654 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). STRONG, Geol. Wis., Surv. 1873–79, I, (1883), p. 436 (Wisconsin).

Mustela pennanti HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 103 (Minnesota). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 198 (Tennessee). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 587 (Indiana).

Type locality — Eastern Canada.

Distribution — Northern North America from the Atlantic nearly to the Pacific and from Hudson Bay to the region of the Great Lakes and further south in the Allegheny Mountains; in the Northwest its range extends to at least latitude 60°; replaced on the Pacific Coast by *M. pacifica*, a closely allied form.

Description — Larger and darker than *M. americana*, and lacking the pale throat patch; ears rather low and rounded; under parts, legs, end of tail and lower portion of back very dark brown or blackish brown; head and shoulders grizzly gray, much lighter than the rest; lining of ear whitish; claws brownish white; tail bushy. The females are smaller than the males.

Measurements — Total length, about 35 in. (890 mm.); tail vertebræ, 13.50 in. (343 mm.); hind foot, 4.25 in. (108 mm.).

Although for many years the Fisher has been supposed to be extinct in Wisconsin, it is by no means improbable that a few individuals may still exist in some of the extreme northern counties. I am informed by hunters that it is occasionally taken in the wilder portions of the Michigan peninsula and there are three specimens from Michigan in the Field Museum collection; two from Park Siding, Iron Co., taken in 1900, and another from Amasa, Iron Co., taken in 1898. Mr. Charles Brandler informs me that he saw a Fisher which had been killed by William Robinson in November, 1900, south of Iron Mountain between that place and Pembine, Florence Co., Wisconsin, the locality being either actually in Wisconsin or very close to the state line. In early days its range extended south to northern Illinois. Kennicott records it from Cook Co., Illinois, and says: "The Fisher used frequently to

Fisher (*Musiela pennanti*).

be seen in the heavy timber along Lake Michigan (*l. c.*, 1854, p. 578) and again later, "It has been found within a few years in northern Illinois and appears to be an inhabitant of the woods alone" (*l. c.*, 1859, p. 241). Strong (1883) says it was found in Wisconsin in the same districts as the Pine Marten in the northern and central portions of the state (*l. c.*, p. 436). Dr. John T. Plummer informs us that, previous to the year 1820, the Fisher was not uncommon in Wayne Co., Indiana.*

The Fisher is largely arboreal in its habits, climbing trees with great facility; but unlike the Marten it prefers timbered swamps and woods near water, for we are told that in summer frogs form a not inconsiderable portion of its diet. It also eats fish when it finds them, but the name of Fisher, by which it is popularly known, is inappropriate, inasmuch as it rarely catches live fish and by far the greater portion of its food consists of mammals, such as Mice, Hares, Squirrels, Porcupines, etc., varied occasionally by birds and eggs. That it does not confine itself when in search of prey to animals smaller than itself is vouched for by various writers. Dr. Elliott Coues states that it kills the Raccoon, and Seton says he has been told by trappers that it will attack and kill Foxes.† To cap the climax Mr. Manly Hardy claims it has been known to kill a full grown Deer. He says: "In spite of their small size and light weight, Fishers not only kill Deer, but can and do kill those of the largest size. When I first heard of this I doubted it, but know now that they often do it. A year ago last fall, my old friend, Louis Ketcham, was following the track of a large buck near the head of Nahmakanta Lake. In going along the side of a high granite ledge he saw where the buck had fallen, and there was blood on the snow. After stumbling along a few rods, it had fallen again, and there was more blood. This was repeated several times, and then he saw where the buck had struck a Fisher which had been clinging to its neck and biting it, and had knocked it several feet to one side. The Fisher was evidently badly hurt, as Louis said it dragged its hind-legs, making a track in the snow like an Otter, and had crawled into a crack in the ledge. On going back he found that the Fisher had been on top of the ledge, where the Deer path led along close to it, and had sprung down upon the Deer and was trying to bite the jugular vein. I have known of instances where they have been successful in doing this."‡

The Fisher is one of the few animals which prey habitually upon the Porcupine. Mr. E. T. Seton says: "George Linklater, for many years

* Amer. Journ. Sci. and Arts, XLVI, 1844, p. 246.

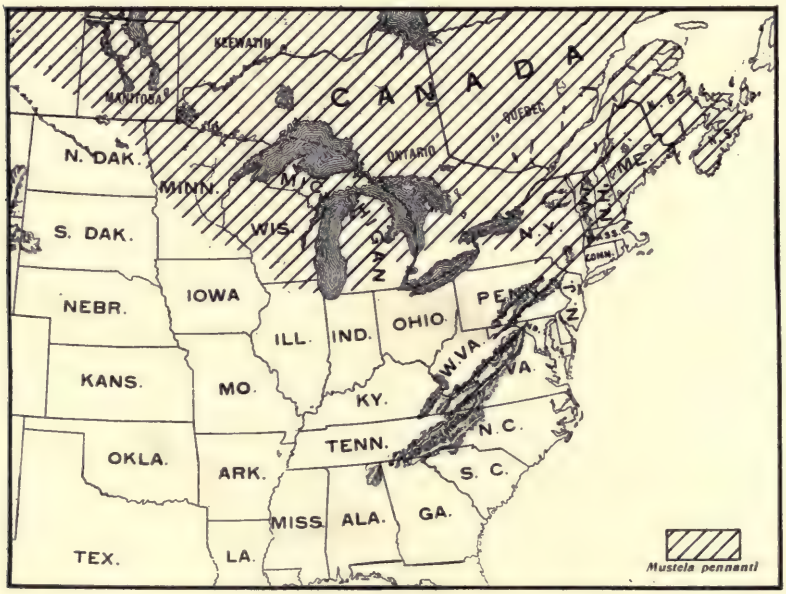
† Life Histories of Northern Animals, II, 1909, p. 939.

‡ Shooting and Fishing, April 13, 1899, p. 526.

a chief trader for the Hudson's Bay Company at many different posts, has handled hundreds of Fisher pelts, but never saw one without some Porcupine quills in it." (*l. c.*, p. 943.)

Dr. C. Hart Merriam says: "During a recent visit to the north shore of the Gulf of St. Lawrence I was informed, both by an agent of the Hudson's Bay Company and by the trappers themselves, that porcupines constitute a large and important element in the food supply of the Pekan. Mr. Nap. A. Comeau, of Godbout, who secured for me a large and handsome male of this species, tells me that its intestine contained hundreds of porcupine quills, arranged in clusters, like so many packages of needles, throughout its length. In no case had a single quill penetrated the mucous lining of the intestine, but they were, apparently, passing along its interior as smoothly and surely as if within a tube of glass or metal."*

Most authorities agree that the Fisher makes its nest in a hollow tree, usually at a considerable distance from the ground, but it has been known to breed in hollow logs and rocky crevices. MacFarlane tells us that in the northern Mackenzie River district the nest is in a



Map illustrating approximate range of *Mustela pennanti* during the latter part of the last century in eastern United States and Canada south of latitude 52°; in the Northwest its range extends at least to latitude 60°. At the present time it is unlikely that it occurs south of the Michigan peninsula or extreme northern Wisconsin.

* Mamm. Adirondack Reg., 1886, p. 49.

hole in the ground.* Robert Kennicott says it "chooses its retreat in the cavity of a standing tree. Almost as arboreal as a squirrel, it not only climbs trees and leaps from bough to bough, but pursues its prey among the branches, capturing even the nimble gray-squirrel. The leaps of the fisher are often astonishing, as it has been known to spring to the ground from the height of 40 feet" (*l. c.*, p. 242).

The young number from 1 to 5 and are generally born early in May.

Family PROCYONIDÆ. Raccoons.

With the exception of a single oriental genus† the members of this family are confined to the New World. All are of medium size. In some ways they resemble the Bears and at one time were included in the same family. They are plantigrade animals, practically omnivorous, and are at home both in trees and on the ground. The well known Coatis, or Coati Mundis of Tropical America, belong to the family, as well as the curious Crab-eating Raccoon found in South America.

These animals have two tuberculate molars on each side of both jaws and the carnassial teeth differ somewhat from the usual type, being broad with several sharp points on the crowns. Other characters for the family are audital bullæ somewhat flattened and undivided; no alisphenoid canal in American species; condyloid and postglenoid foramina are present; the kidneys are simple and a cæcum is apparently absent; the os penis is long, the terminal portion being curved sharply upward.

Two genera and seven species and subspecies are found in the United States, but only one occurs within our limits. In our species the round bushy tail is marked with distinct dark rings (annulated) and the teeth are 40 in number.

Subfamily PROCYONINÆ.

Genus **PROCYON** Storr.

Procyon Storr, Prodr. Meth. Mamm., 1780, p. 35. Type *Ursus lotor* Linn.

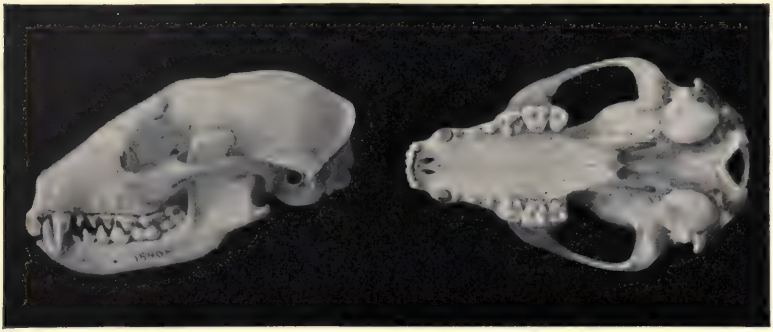
Head broad; muzzle pointed; tail bushy, cylindrical and annulated; ears erect and comparatively short; toes five, on all feet; soles of feet

* Proc. U. S. Nat. Mus., XXVIII, 1905, p. 709.

† Some authorities also include the Bear-like genus *Aeluropus* in this family.

naked; feet plantigrade; upper carnassial with three cusps on outer margin; molars broad and tuberculate; palate extending back of last molar for about ⅓ distance to foramen magnum (more than ½ inch in our species); a palatal spine present; bullæ somewhat flattened and extending laterally in a tubular auditory meatus.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{4-4}$, M. $\frac{2-2}{2-2}=40$.



Skull of Raccoon (*Procyon lotor*).
(About ⅓ nat. size.)

Procyon lotor (LINNÆUS).

RACCOON.

[*Ursus*] *lotor* LINNÆUS, Syst. Nat., X ed., I, 1758, p. 48.

Procyon lotor LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 254 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 184 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 139 (Minnesota). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 197 (Tennessee). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 74 (S. W. Missouri). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 29 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 598 (Indiana).

Type locality — Eastern United States.

Distribution — Whole of the United States east of the Rocky Mountains (except in Florida) and north to southern Ontario and Manitoba; replaced in Florida by a slightly different form.

Description — Snout pointed; hair thick; general color grayish or yellowish gray, the middle of the back blackish; face whitish, with a black patch on cheek, which includes the eye, and a blackish line

on middle of forehead; ears grayish white, becoming dusky at the bases; tail thickly haired and rounded, yellowish gray marked with several blackish rings.

Measurements — Total length, variable, but generally about 28 to 32 in. (703 to 804 mm.); tail vertebræ, 9 to 10.50 in. (229 to 267 mm.); hind foot, about 4.75 in. (120 mm.).

The Raccoon is found throughout our limits wherever there is timber, being common in Illinois and southern Wisconsin, but rather scarce in northern Wisconsin. It is properly an inhabitant of the woods, especially in the vicinity of water, as it is fond of frogs, crustaceans and other aquatic animals which are found along the shore; but it does not confine itself to such food and is practically omnivorous, devouring mammals, birds and birds' eggs, acorns, fruits, berries, etc., and its fondness for green corn is well known.

The Raccoon is largely nocturnal in its habits, but I have occasionally seen one wandering along the shores of ponds and streams in the daytime. Its home is generally in a hollow tree, although it sometimes uses a hollow log or a natural cave in a rocky ledge, and Kennicott claims it will occasionally use a deserted burrow made by another animal (*l. c.*, p. 255). The young are born in April or May and number from 3 to 6.

It is supposed to hibernate in winter in the northern part of its range, but if it does so, it is probably only for a comparatively short time during the coldest weather, as hunters often see their tracks in the snow.

The Raccoon uses its fore-paws like hands, and has a curious habit of dipping its food in water, as if washing it before eating, hence its name — *lotor* — a washer. This habit is very noticeable in captive animals of this species. I have owned a number of Raccoons at various times and have found them very intelligent, and when taken young in most cases affectionate. One, which I kept for several years, was very tame and when released from his cage would follow me about the garden, and when I sat down would clamber up on my shoulder. Upon being given a piece of fish or meat, he would waddle over to a large pan of water, reserved for his use, and would dip and turn his food about in the water before eating it. He was especially fond of honey and sugar and had learned by experience to feel in my pocket for lumps of the latter when I took him out for an airing.

Mr. Vernon Bailey describes an incident which illustrates the intelligence and affection shown by this animal. He says: "While watching for squirrels one morning in the heavily timbered bottoms, I heard a scratching sound from an old cypress in the edge of the

Raccoon (*Procyon lotor*

swamp near by, followed by a loud splash. A young coon less than half grown had fallen from the tree into the water. At the sound the old coon and two more young ones came out of a hollow some 30 feet up in the trunk and climbed down to near the bottom of the tree. They came down the tree slowly but steadily, head first, as a squirrel would have done, with the hind feet reversed and slightly divergent. When the old coon saw the young one climb out of the water upon the tree trunk she turned about and ascended the trunk, followed by the

Map illustrating approximate distribution of Raccoons in eastern North America.

Procyon l. (LINN.). Type locality — Eastern United States. Description as previously given.

Procyon l. elucus BANGS. (Proc. Bost. Soc. Nat. Hist., XXIX, 1898, p. 219.) Type locality — Oak Lodge, opposite Micco, Brevard Co., Florida. General color above more yellowish than *lotor;* shoulder tinged with yellowish rufous; fur shorter.

three young. The one that had fallen, besides being very wet, was slightly hurt, and climbed with difficulty. When halfway up he stopped on a limb to rest and began whimpering and crying. The mother had already reached the hole, but on hearing his cries turned about and climbed down to him. Taking a good hold of the back of his neck and placing him between her fore legs so that he, too, could climb, she marched him up the tree and into the hollow."*

Specimens examined from Illinois and Wisconsin:

Illinois — Joliet, 1; Rosiclare, Hardin Co., 1; Olive Branch, Alexander Co., 3; Chicago, 1; "Illinois" (melanistic), 1 = 7.

Wisconsin — "Wisconsin" (albino), 1; (M. P. M.) Milwaukee, 1; Prescott, Pierce Co., 1; Waukesha, 2; Prairie du Sac, 1; Roxbury Dam, 3; Maiden Rock, 2; Pewaukee, 1; (O. C., skulls) Gordon, Douglas Co., 6; Waterford, Racine Co., 1; Barron Co., 1; Waukesha Co., 1; Langlade Co., 1; Pewaukee, Waukesha Co., 3; (S. C.) Beaver Dam, Dodge Co., 4; (O.) Lake Geneva, Walworth Co., 1 = 30.

Family URSIDÆ. Bears.

Bears are widely distributed throughout the world, but are absent in the Ethiopian and Australian regions. They are plantigrade animals and practically omnivorous. The majority of the species belonging to this family are large animals, one of them, which is found in Alaska, being the largest known member of the order. The toes are armed with strong claws, long and but slightly curved in the so-called Grizzly Bears in North America; and sharper, shorter and more curved in our Black Bears. The teeth are large, the molars having flattened, tubercular crowns. The fourth upper premolar (carnassial) is smaller than the first molar and lacks the third inner root. It differs from the usual type, the crown being broad with elongated cusps. The cæcum is absent and there are four mammæ, all pectoral; the kidneys are lobate.

Other characters for this family are: all feet with five toes; palms of feet naked (except the Polar Bear, *T. maritimus*); tail very short; audital bullæ flattened and undivided; condyloid and glenoid foramina distinct; alisphenoid canal present in American species; molars, $\frac{2-2}{3-3}$.

Bears hibernate to a more or less extent in North America, even

* N. Amer. Fauna, No. 25, 1905, p. 194.

the species which is found in Florida continuing the habit when the occasion for it no longer exists.*

Two genera and some fifteen species and subspecies are found in North America, but only one, the Black Bear, *Ursus americanus*, occurs within our limits.

Genus **URSUS** Linnæus.

Ursus Linnæus, Syst. Nat., X ed., I, 1758, p. 47. Type *Ursus arctos* Linn.

Size large; feet plantigrade; claws not retractile; toes 5 on both fore and hind feet; tail very short; true molars with broad tuberculate crowns; upper carnassial smaller than 1st molar, having a broad crown with elongated cusps; audital bullæ depressed and but very slightly inflated; color of our species black or brown.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{4-4}$, M. $\frac{2-2}{3-3}=42$.

Subgenus **EUARCTOS** Gray.

Ursus americanus PALLAS.

BLACK BEAR.

Ursus americanus PALLAS, Spicilegia Zoologica, fasc. 14, 1780, p. 5. LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1858, U. S. Patent Office Rept., 1859, p. 251 (Illinois). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 655 (Illinois). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin). HERRICK, Geol. Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 140 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 136 (Indiana). BUTLER, Proc. Ind. Acad. Sci., 1894 (1895), p. 84 (Indiana). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 199 (Tennessee). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 592 (Indiana). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 30 (Wisconsin). *Ib.*, VIII, 1910, p. 89 (Wisconsin).

Ursus americana MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 220 (Michigan). GARMAN, Bull. Essex Inst., XXVI, 1894, p. 3 (Kentucky).

Ursus arctos ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 184 (Iowa). OSBORN, Proc. Iowa Acad. Sci., I, 1887–89 (1890), p. 42 (Iowa).

Ursus cinnamomum STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 437 (Wisconsin).

* The Florida Black Bear retires into its den early in January and hibernates until about the first of March. That this habit is due to hereditary instinct and not to climatic conditions or lack of food is suggested by the fact that in southeastern Florida the weather is warm and the berries of the palmetto (*Serenoa serrulata*), which are a favorite food of these animals, are still very abundant at that season.

Type locality — Eastern North America.

Distribution — Practically the whole of North America, from Texas to Labrador and Alaska; replaced in the Gulf States, Labrador, and the extreme West and Northwest by allied forms.

Description — Size large; body thickly furred; general color black (sometimes brown), often with a white spot on the breast; ears rounded; face tinged with cinnamon brown or tan brown.

Measurements — Size variable; adult males from Wisconsin will generally weigh from 250 to 350 lbs. and have a total length of from 60 to 70 inches; height at the shoulder, about 30 inches; tail, about 5 inches; and hind foot, about 8 inches.

Up to the middle of the last century Black Bears were common in wooded localities in Illinois, and probably a few individuals survived in the northwestern and southern parts of the state to a considerably later date. There have been rumors of Bears having been seen in the swampy country in extreme southern Illinois as late as 1885 or 1890, but the evidence is unsatisfactory. The latest authentic record I can find for Illinois is that of Mr. C. J. Boyd of Anna, who writes: "The last Bear was killed by David Brown in 1860 in the hills near Alexander Co." Kennicott (1854) states that Bears were formerly seen in Cook Co. (*l. c.*, p. 578); and Thomas (1859) says, "It is occasionally seen in the southern part of the state, although once found in considerable numbers" (*l. c.*, p. 656). So much for Illinois.

According to Hahn it was found in Indiana at a somewhat later date, as he records one being killed in Green County in 1870 and another in 1875. Two young Bears were reported killed in Knox Co., Indiana, in 1882 (*l. c.*, p. 594). That they were common enough in the state in early days is shown by the statement of Dr. John T. Plummer, who informs us Bears were killed in the immediate neighborhood of Richmond, Wayne Co., and in the year 1824 some cubs were taken within a mile of the town.*

Black Bears are, however, still common in northern Wisconsin. Jackson says: "Black Bears have reappeared in Oneida County since 1907 and are reported more plentiful in Vilas County. In late June, 1908, a female and two cubs were killed near Wolf Lake, Oneida Co. and there have been reports of others seen in the region nearby" (*l. c.*, p. 89).

During the past six years I have made inquiries of a number of gentlemen living in various parts of northern Wisconsin as to the presence or absence of some of the larger mammals in their vicinity. Many of them are experienced hunters and are well acquainted with

* Amer. Jour. Sci. & Arts, XLVI, 1844, p. 246.

Black Bear (*Ursus americanus*).

the animals in question. Others, who do not hunt themselves, were kind enough to secure the desired information from hunters and trappers in their vicinity. In a number of cases my correspondents claim that Bears are more plentiful than formerly, as, for example, to cite one of many, Mr. W. J. Webster, Superintendent of Schools, Park Falls, Price Co., under date of January 13, 1910, writes, "Several Bears have been killed here; they are more numerous the past few years."

I am reliably informed that Bears were killed in the following counties in Wisconsin during the years 1908, 1909, 1910: Florence Co. (J. E. Parry, Florence); Marinette Co. (J. Stovekere, Jr., Pembine; L. Johnson, Beaver; G. A. Williams, Kremlin); Oneida Co. (J. Dapres, Hazelhurst); Marathon Co. (G. F. Erzwein, Athens); Oconto Co. (E. Phenney, Oconto Falls); Buffalo Co. (J. Bream, Cream; E. F. Ganz, Alma); Vilas Co. (N. L. Kinney, Eagle River); Taylor Co. (J. Hobbs, and C. W. Benn, Medford); Price Co. (W. J. Webster, Park Falls; F. J. Sulter, Prentice); Bayfield Co. (H. Feltz, Bayfield; M. Berg, Cable; E. J. Carter, Drummond; B. P. Hill, Bayfield); Burnett Co. ("There are four or five Bears killed here every year"— O. Erickson, Grantsburg; L. Larson, Oakland); Rusk Co. (F. E. Munroe, Ladysmith); Douglas Co. (D. Farnham, Manley; N. Lucins, Jr., Solon Springs; G. W. Zeon, Foxboro); Iron Co. (J. Ball, Sandrock; J. Miller, Cedar).

To the above I may add the following records which I find in my note book for 1907: Male killed Sept. 14, 1906, Hazelhurst, Oneida Co. (J. Dapres). Bear killed June, 1906, near Pembine, Marinette Co. (J. Stovekere). Bear killed December 22, 1906, Oconto Falls, Oconto Co. (E. Phenney). Two Bears killed October, 1906, Eagle River, Vilas Co. (N. L. Kinney). Bear killed October 5, 1906, Medford, Taylor Co. (J. Hobbs). "Several Bears killed in this vicinity in 1906; one killed February 14, 1907," Bayfield, Bayfield Co. (H. Feltz). "A Bear was killed in this county in the summer of 1906." (C. E. Brown, Hamilton, Fond du Lac Co.). In the winter of 1909 two Bears were offered for sale in a Chicago market, one of which I was informed came from Washburn County and the other was said to have been killed in Polk County.

The above records show that at the present time Black Bears are pretty well distributed throughout the northern half of Wisconsin; the one reported killed in Fond du Lac County may have been a straggler, or originally a tame animal.

The Black Bear is naturally an inhabitant of the forest, although in his wanderings he may often be found in open valleys and hills, especially in the berry season. He is one of the most omnivorous of our

flesh eaters and his varied diet includes mammals ranging from Mice to Sheep and young cattle, as well as birds, fish, frogs, insects, berries of various kinds and, in fact, almost anything edible. He is extremely partial to honey, and unlike the Grizzly Bear, he is a good tree climber, and is generally able to rob a bee tree whenever he finds one. He tears open old rotten stumps and turns over logs and rocks in search of grubs and ants of which he seems to be particularly fond. In the berry season, when berries form a not inconsiderable part of his diet, he may be looked for in localities where they are plentiful, and although a nocturnal animal, may be seen occasionally in the daytime on open hillsides indulging his taste for them.

Notwithstanding the popular opinion to the contrary, the Black Bear is a shy animal and unless badly wounded will rarely attack man. I have killed seventeen Black Bears in different parts of the United States and have never had one charge or show fight, except when badly wounded and unable to run away. At such times they are undoubtedly more or less dangerous, as almost any wild animal would be when cornered and desperate. I have never shot a female with cubs; but there is little doubt that she will fight to protect them, especially if they are very young.

The Black Bear hibernates in winter;* in fact, it does so to a more or less degree throughout its range without regard to temperature, although the scarcity of food during the cold months was probably the primary cause of the development of the habit in these animals. The length of its sleep varies in different parts of the country, being undoubtedly influenced by temperature to that extent. In the more southern portion of its range its sleep is not profound and in the case of the Florida Bear, as I know from personal experience, they are easily disturbed.

The den is usually an excavation under some log or hollow in a large tree and, when available, a natural cave is often used. The young are born late in January, or early in February, in this latitude, and number from 1 to 4, the usual number being two. They are very small at birth in comparison with the size of the mother, measuring from 8 to 10 inches in length and rarely exceeding a pound in weight, the average weight being considerably less.

The flesh of the young Bear is tender and palatable, but that of an old one is coarse and usually very tough. The oil from the fat is, in my opinion, much better than lard for frying purposes, as the flavor is delicate, and in culinary phraseology "it does not burn."

* This peculiar physiological condition has already been discussed in connection with other mammals. See pages 142 and 250; also Index.

To hunt Bears successfully dogs are absolutely essential, and unless one is a trained athlete the country must be sufficiently open to permit of the use of horses to follow the hounds for at least a considerable portion of the time. In a heavily wooded, rough country shooting a Bear is largely a matter of chance; their senses of smell and hearing are so exceedingly keen that one may hunt for weeks in a good Bear country and not see one. Of course, they can be trapped; but unless there is some good reason for desiring the death of the animal it is a cruel and unsportsman-like method.

Good Bear dogs are not easy to find. It is a curious fact that while almost any hound will eagerly follow the trail of a Panther, a very small percentage of them will follow that of a Bear. I have found that the best Bear dogs were generally a cross between a hound and a bull dog. Occasionally a full blooded hound will follow a Bear, but judging from my experience, except when in company with a number of other dogs, such cases are rare. The perfect Bear dog is one that will follow the trail until he sees the animal and then worry and "bay" him until the hunter can come up to them, but he must be wise enough not to get within reach of the Bear's paws. If he has too much courage and is reckless, he is killed or badly injured, but on the other hand, if he lacks the proper amount of courage, he will not follow the trail at all.

In Wisconsin a full grown Bear will usually weigh from 250 to 350 pounds. The latter would be considered a large animal for this part of the country, but the southern races of the Black Bear grow much larger. In Florida and Louisiana a male weighing 500 pounds, while larger than the average, is by no means uncommon and, although I have never actually weighed a Florida Bear that tipped the scales at more than 511 pounds,* I have killed larger animals, one of which I estimated to weigh nearly 600 pounds.

Brown Bears, which may be found within our limits, are merely color phases of the Black Bear, black and brown cubs having been found in the same litter.†

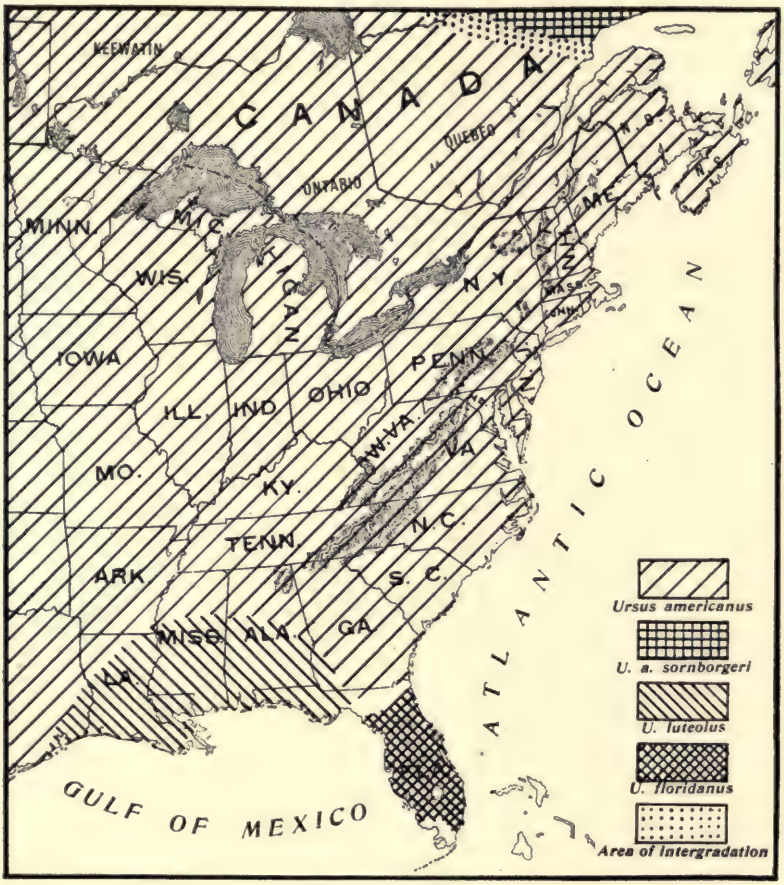
When taken young and kindly treated, Bear cubs make very amusing pets, as they are intelligent and playful; but as they grow up, their play is inclined to be rather too rough. If teased or irritated, however, they soon become treacherous.

During the seventeenth century Black Bears were very numerous throughout New England and their "grease" was much used by early

* The two largest males weighed 489 and 511 pounds.

† See Kennicott, *l. c.*, p. 253; also Journals of Alex. Henry and David Thompson. (Edited by Elliott Coues.) 1897, p. 449.

settlers as a cure for various ailments, such as rheumatism, sprains, etc. Many curious tales concerning them are told by early writers, the following being examples.



Map illustrating the approximate distribution of Black Bears in eastern United States and Canada south of latitude 52.

Ursus americanus PALLAS. Type locality — Eastern United States. Description as previously given.

Ursus a. sornborgeri BANGS. (Amer. Nat., XXXII, 1898, p. 500.) Type locality — Okak, Labrador. "Skull smaller, shorter and broader" (Bangs).

Ursus luteolus GRIFFITH. (Carniv. Anim., 1821, p. 236.) Type locality — Louisiana. A large form with heavier dentition; forehead flattened.

Ursus floridanus MERRIAM. (Proc. Biol. Soc. Wash., X, 1896, p. 81.) Type locality — Key Biscayne, Dade Co., Florida. As large or larger than *luteolus;* color entirely black; forehead elevated.

Josselyn says: "The Bear they live four months in Caves, that is all Winter; in the spring they bring forth their young ones, they seldom have above three Cubbs in a litter, are very fat in the Fall of the Leaf with feeding upon Acorns, at which time they are excellent Venison; their Brains are venemous; They feed much upon water Plantane in the Spring and Summer, and Berries, and also upon a shell-fish called a Horse-foot; and are never mankind, *i. e.*, fierce, but in rutting time, and then they walk the Country twenty, thirty, forty in a Company, making a hedius noise with roaring, which you may hear a mile or two before they come so near to endanger the Traveller."*

Wood writes: "Most fierce in strawberry-time at which time they have young ones; at which time likewise, they will go upright, like a man, and climb trees, and swim to the islands; which if the Indians see, there will be more sportful bear-baiting than Paris garden can afford; for, seeing the bears take water, an Indian will leap after him; where they go to water-cuffs for bloody noses and scratched sides. In the end, the man gets the victory; riding the bear over the watery plain, till he can bear him no longer."†

Specimens examined from Wisconsin and adjoining states:

Wisconsin — "Northern Wisconsin," 3; (O. C.) Price Co. (skulls), 2; (S. C.) Cayuga, Ashland Co. (skull), 1; (O.) Washburn Co., 1; Polk Co., 1 = 8.

Michigan — Park Siding, Iron Co. (skull), 1.

Minnesota — (brown phase), 2.

* New England Rarities, 1672, p. 48.

† New England's Prospects, 1634, p. 16.

Order INSECTIVORA.

INSECT EATERS.

Representatives of this large order are found throughout the greater portion of the temperate and tropical world, except, so far as known, in Australia and South America. All of its members are comparatively small animals. The greater number are terrestrial, although a few are arboreal and others natatorial. They are nearly all of them nocturnal animals; some are covered with spines, but the majority are thickly furred. They are largely, but by no means strictly, insectivorous; most of our species eat great numbers of earth-worms and young Mice when they can get them; while some species, like the European Hedgehog, have such a varied diet as to be practically omnivorous.

While in all known species, incisors, canines, premolars and molars are present, most of them are not clearly differentiated and for convenience all single pointed teeth are called unicuspids. The number of teeth varies in different species, some having as high as 44. In our Shrews belonging to the subfamily *Soricinæ* the ends of the teeth are colored red, while in the *Crocidurinæ*, and Old World subfamily, the teeth are entirely white. There seems to be a tendency in many of the members of this order towards the disappearance of milk teeth. In the species belonging to the genus *Sorex*, for example, there are but seven milk teeth and none of them ever become functional. These animals are characterized by having an elongated snout, with the upper lip extending considerably beyond the lower; clavicles are present in all except the peculiar African genus *Potamogale*. The position of the mammary glands and number of teats vary in different species. The uterus is bicornate and the placenta discoidal and deciduous. The cæcum is absent in our species. The majority possess glands containing a strong, disagreeable, musky secretion, which is supposed to be a means of protection, as it is claimed carnivorous mammals will rarely eat them. The location of these glands varies in different species; in our Shrews they are usually located on the sides of the body behind the axilla. The toes are armed with claws which in many species are highly developed for digging. Shrews do not hibernate and are active all winter.

On the North American continent the order is represented by two families: *Soricidæ*, Shrews, and *Talpidæ*, Moles, comprising more than

a hundred species and subspecies; while a third family (*Solenodontidæ*) occurs in the West Indies. Eleven species and subspecies belonging to 5 genera, including representatives of both of our continental families, are found within our limits.

Suborder INSECTIVORA VERA.

KEY TO THE FAMILIES

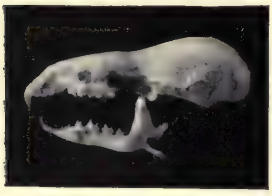
REPRESENTATIVES OF WHICH OCCUR WITHIN OUR LIMITS.

A. Length from nose to root of tail more than 4 inches; fore feet modified for digging, very large and strikingly different from hind feet; no external ear; ends of teeth not red; zygomata present. **Family TALPIDÆ. Moles,** p. 433.

B. Length from nose to root of tail less than 4 inches; fore feet not noticeably large; external ear present, although small and often concealed by fur; ends of teeth red; zygomata absent. **Family SORICIDÆ. Shrews,** p. 406.

Family SORICIDÆ. Shrews.

Members of this family are distributed throughout the northern hemisphere, except in high latitudes. They are small, terrestrial mammals (rarely aquatic), somewhat resembling a Mouse, but having a long pointed snout; the upper lip projects considerably beyond the lower; very small eyes and very small external ears which are often concealed by fur. Their bodies are covered with thick, soft fur. The tibia and fibula are united; zygomata are absent and the tympanic bone is shaped like a ring and does not form a bulla. The milk teeth are functionless and absorbed without appearing above the gum. The cusps on the upper molars may be described as resembling the letter W. There is no cæcum. Their food consists principally of insects and worms, and it is claimed that some species occasionally eat nuts. They are distinctly pugnacious and when opportunity occurs will attack, kill and eat small mammals, such as Mice.



Skull of a Shrew (*Sorex*). (Enlarged.)

In writing of Old World Shrews, Edward Topsell says:* "It is a

* Historie of Foure Footed Beastes, London, 1607, p. 536.

ravening beast feygning it selfe to be gentle and tame, but being touched it biteth deepe, and poisoneth deadly. It beareth a cruell minde, desiring to hurt anything neither is there any creature that it loveth, or it loveth him, because it is feared of all. The Cats as we have said do hunt it, and kill it, but they eat not them."

Shrews were held sacred in Egypt from their supposed blindness, being regarded as an emblem of primal night and darkness. Herodotus states that the City of Buto was a place of sacred sepulture for these animals and according to Pettigrew specimens of mummied Shrews (*Sorex*) have been found at Thebes.*

Three genera and some 75 or more species and subspecies are found in North America:

KEY TO OUR GENERA.

GROUP 1. Tail decidedly more than ¼ total length; ears visible.

SECTION 1. More than 3 unicuspid teeth, large enough to be readily seen on each side of upper jaw.

Hind foot not fringed. Genus SOREX, p. 410.

Hind foot fringed. Genus NEOSOREX, p. 420.

SECTION 2. Only 3 unicuspid teeth, large enough to be readily seen on each side of upper jaw; size small. Genus MICROSOREX, p. 418.

GROUP 2. Tail less than ¼ total length; ears hidden by fur. Genus BLARINA, p. 422.

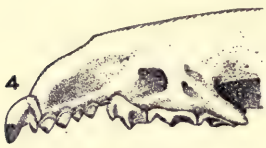
English naturalists tell us that these little animals have always been the subject of many foolish superstitions in Europe, one of the most popular being the belief that, if a Shrew ran over the foot of a beast or a man (in the case of the latter shoe leather seems to have been no protection), it would cause serious lameness and often much suffering. Luckily immediate relief could always be obtained by touching the unfortunate victim with the twig "Shrew-ash." To prepare this wonderful remedy a hole was bored in a tree and in it was placed the twig of an ash tree and a live Shrew, the opening being then sealed up. When the twig was thoroughly medicated it was removed, and was supposed to retain its curative power for an indefinite period.

* Hist. Egyptian Mummies, 1834, p. 195.

Blarina brevicauda.

Blarina brevicauda carolinensis.

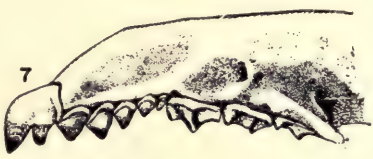
Blarina parva.



Sorex longirostris.

Sorex personatus.

Sorex fumeus.



Sorex richardsonii.

Microsorex hoyi.

Neosorex palustris.

Upper Jaws and Teeth of Shrews, greatly enlarged. (After Merriam.)

There is a surprising difference in the shape and size of both the skulls and the teeth in old and young Shrews of the same species, and, when comparing skulls for the purpose of identification, the student should select specimens of about the same age.

KEY TO THE SPECIES.

GROUP 1. Short-tailed Shrews. Ears completely concealed by fur; tail not exceeding one inch in length, usually decidedly less and always less than ¼ total length (nose to tip of tail).

SECTION 1. Total length more than 3.60 inches.

General color dusky slate color, under parts only slightly paler; teeth 32; four well developed unicuspid teeth, first two longer than third and fourth, the third and fourth about equal; total length about 5 inches, averaging a little less; occurs in northern Illinois and Wisconsin. SHORT-TAILED SHREW OR MOLE SHREW.
Blarina brevicauda, p. 423.

Similar to *brevicauda* but smaller; back sometimes faintly washed with brown; teeth 32; total length about 4 inches; occurs from central Illinois southward. CAROLINA SHORT-TAILED SHREW.
Blarina b. carolinensis, p. 428.

SECTION 2. Total length less than 3.60 inches.

Brown or iron-gray above, ashy on under parts; teeth 30; fourth upper unicuspid exceedingly small and apparently absent, difficult to see without a good lens and rarely visible from outside; occurs in Illinois but not in Wisconsin. SMALL SHORT-TAILED SHREW.
Blarina parva, p. 430.

GROUP 2. Long-tailed Shrews.* Ears very small but visible, being not entirely concealed by fur; tail more than one inch in length and always more than ¼ total length.

SECTION 1. Total length less than 5.25 inches; feet not fringed.

PART. 1. Total length less than 4 inches.

Upper parts dull chestnut-brown, approaching sepia brown; under parts ashy gray, often washed with pale drab brown; tail usually less than 1.38 in. (35 mm.); hind foot .43 in. or less (11 mm.); third unicuspid tooth smaller than the fourth. CAROLINA SHREW.
Sorex longirostris, p. 416.

Upper parts approaching sepia brown; under parts ashy, gray or brownish ash; tail usually more than 1.38 in. (35 mm.); hind foot about .47 in. (12 mm.); third unicuspid tooth not noticeably smaller than the fourth. COMMON SHREW. *Sorex personatus*, p. ——

Upper parts approaching sepia brown; under parts ashy gray or pale brownish gray, often washed with buff on throat and breast; tail less than 1.38 in. (35 mm.); hind foot .43 in. or less (11 mm.); apparently only 3 unicuspid teeth present, the 1st, 2d and 4th, the third being so small and concealed between the others as to be seen with more or less difficulty (cannot be seen at all without the aid of a strong lens); "a distinct secondary cusp on the inner side of the canine and second and third upper incisors" (Miller); occurs in Wisconsin and probably in extreme northern Illinois. HOY'S SHREW.
Microsorex hoyi, p. 418.

* In all our Shrews the tail would be considered short. These are called Long-tailed Shrews only by comparison with the very short-tailed species belonging to the genus *Blarina*.

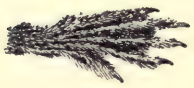
PART 2. Total length more than 4 inches but less than 5.

Upper parts approaching sepia brown; under parts ashy, gray or brownish ash; tail more than 1.38 in. (35 mm.); 3d unicuspid not smaller than 4th; hind foot about .47 in. (12 mm.); total length about 4 inches; occurs in Illinois and Wisconsin. COMMON SHREW. *Sorex personatus*, p. 411.

Back about same color as sides; upper parts dark slaty plumbeous; under parts slightly paler and washed with ashy; third unicuspid not smaller than the fourth, usually slightly larger. The animal appears nearly uniform in color, although slightly paler on under parts; a brown pelage occurs in which the pelage is everywhere chestnut brown, somewhat paler on the under parts; found in Wisconsin and perhaps extreme northern Illinois. SMOKY SHREW. *Sorex fumeus*, p. 415.

Color of back noticeably different from the sides; back very dark brown; sides fulvous brown or buffy brown; under parts ashy plumbeous, more or less washed with brownish; third unicuspid usually decidedly larger than the fourth; a brown pelage occurs in summer very similar to that of *Sorex fumeus;* occurs in Wisconsin but has not been taken in Illinois. RICHARDSON'S SHREW. *Sorex richardsonii*, p. 414.

SECTION 2. Total length more than 5.25 inches; feet fringed.



Foot of *Neosorex palustris.*

Back blackish seal brown; under parts ashy white; *feet fringed;* occurs within our limits from central Wisconsin northward. WATER SHREW OR MARSH SHREW. *Neosorex palustris*, p. 421.

Subfamily SORICINÆ.

Ends of teeth and crown tubercles colored red; zygomata absent.

Genus **SOREX** Linnæus.

Sorex Linnæus, Syst. Nat., X ed., I, 1758, p. 53. Type *Sorex araneus* Linnæus.

Size small; tail more than one-third the total length; external ear not entirely concealed by fur; snout pointed; first upper incisor long, curved and hook-like; inner sides of canines and incisors without secondary cusps; skull delicate; brain case broad; milk dentition not functional.

Dental formula: I. $\frac{4-4}{2-2}$, C. $\frac{1-1}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3}=32$.

Subgenus **SOREX** Linnæus.

Sorex personatus GEOFFROY ST. HILIARE.

COMMON SHREW.

Sorex personatus I. GEOFFROY ST. HIL., Mém. Mus. d'Hist. Nat. Paris, XV, 1827, p. 122. MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 60 (Indiana, Michigan, Minnesota, etc.). MILLER, N. Amer. Fauna, No. 10, 1895, p. 53 (Minnesota, etc.). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 202 (Tennessee). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 30 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 604 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 581.

Sorex Forsteri LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin).

Sorex cooperi KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 96. ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 48 (Minnesota).

Sorex platyrhinus EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 133 (Indiana).

Type locality — Eastern United States.

Distribution — Northern North America, from about the latitude of Virginia north to Hudson Bay and Alaska.

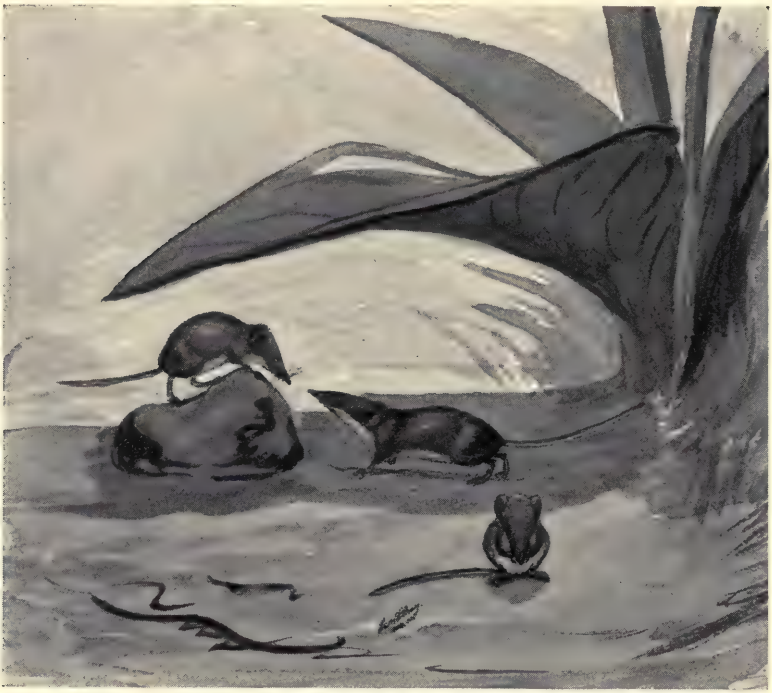
Description — Upper parts approaching sepia brown (rarely chestnut); under parts ashy gray or brownish ash; upper surface of tail and tip blackish; under surface of tail whitish; 3rd unicuspid tooth not smaller than the 4th. (See illustration, page 408.)

Measurements — Total length, about 3.95 in. (100 mm.); tail vertebræ, 1.50 in. (38 mm.); hind foot, .50 in. (12.5 mm.).

Remarks — The chestnut phase of pelage, which occasionally occurs, is apparently rare. There are two specimens in this Museum in brown pelage from Sumner, Wisconsin; one taken by L. Kumlien in May, 1860, and the other by T. Kumlien in June, 1880; the former was found impaled on a thorn by a shrike. According to Dr. Merriam, "Out of 20 specimens from Roan Mountain, North Carolina, only 2 are chestnut" (*l. c.*, p. 60).

The Common Shrew is found throughout Illinois and Wisconsin. Kennicott reports it from Murphysboro, Jackson County, in southern Illinois, and states it is not uncommon in the northern part of the state (*l. c.*, p. 96). Wood reports specimens from McLean and McHenry counties and there are specimens in the Field Museum from Lake County.

Jackson considers it common in most parts of Wisconsin, as it doubtless is. I have examined specimens from various localities in



Common Shrew (*Sorex personatus*).
(About ½ nat. size.)

the interior and several of the most northern counties including Douglas, Iron, Florence, and Vilas.

This diminutive species usually makes its home under an old log or stump or beneath the roots of a tree; sometimes it uses a hole in a fallen tree. In open fields and meadows it is often found under haycocks.

Shrews are both diurnal and nocturnal, but they are so small and active they are rarely seen. Probably not one person in a hundred has ever seen a dead Shrew and the percentage is very much less for those who have seen a live one in its natural haunts. Sometimes a hunter, while remaining perfectly still, watching for game, may catch a fleeting glimpse of one of these little animals as it hurries across an open space among the leaves, but in most cases it would pass unnoticed. Dr. C. Hart Merriam says: "The naturalist well knows that, however cautiously he may walk, the stir of his footsteps puts to flight many forms of life that will reappear as soon as quiet is restored; therefore, in his excursions through the woods, he waits and watches, frequently stopping to listen and observe. While thus occupied it sometimes happens that a slight rustling reaches his ear. There is no wind, but

the eye rests upon a fallen leaf that seems to move. Presently another stirs and perhaps a third leaf turns completely over. Then something evanescent, like the shadow of an embryonic mouse, appears and vanishes before the retina can catch its perfect image. Anon, the restless phantom flits across the open space, leaving no trace behind. But a charge of fine shot, dropped with quick aim upon the next leaf that moves will usually solve the mystery. The author of the perplexing commotion is found to be a curious, sharp-nosed creature no bigger than one's little finger, and weighing hardly more than a dram. Its ceaseless activity, and the rapidity with which it darts from place to place, is truly astonishing, and rarely permits the observer a correct impression of its form."*

Herrick gives an interesting description of the action of a pair of these Shrews which he observed at night in Pine Co., Minnesota. He says: "To a person alone in the woods for the first time after a long interval every sound is novel and more or less charged with mystery. The wind stirred the tree tops and impinging boughs clattered and the trunks groaned under the tortion, each tree with its own doleful note. The few remaining pines added their sighing to the many melancholy sounds belonging to the autumn forest at night. But amid all the sounds nothing could be identified as coming from anything living, even the distant howling of wolves was silenced, and I began to feel that the attempt to gain personal knowledge of the ways of woodsy mammals by night study would prove futile, and composed myself to sleep. The half-somnolent revery which forms the prelude to slumber, was broken by faint melodious sounds on an excessively high key — so high that it seemed that I might be simply hearing the lower notes of an elfin symphony, the upper registers in which were beyond the powers of human ears to distinguish. The sounds were distinctly musical and reminded me of the contented twitter of birds finding resting places among the boughs at night. Without moving I turned my eyes upon the fire-lit circle, about which the darkness formed an apparently impenetrable wall. Only the most careful scrutiny enabled me to discover the tiny musicians. Within a few feet of my head, upon a decayed log, raced a pair of shrews (*S. cooperi*), so minute as to escape my observation at first. Up and down with the most sprightly imaginable motions they ran, twittering incessantly. Hither and thither they scampered over my clothing and almost into my pockets, like veritable lilliputians, seizing now a crumb of cheese, with which my traps were baited, and now a bit of fish fallen from my improvised supper table" (*l. c.*, p. 41).

* Mamm. Adirondack Reg., 1886, p. 174.

The food of these Shrews consists largely of worms and insects, but they also eat flesh and probably devour young Mice and the young of the smaller ground-nesting birds whenever they find them. Dr. C. Hart Merriam says: "Not only are these agile and restless little Shrews voracious and almost insatiable, consuming incredible quantities of raw meat and insects with great eagerness, but they are veritable cannibals withal, and will even slay and devour their own kind. I once confined three of them under an ordinary tumbler. Almost immediately they commenced fighting, and in a few minutes one was slaughtered and eaten by the other two. Before night one of these killed and ate its only surviving companion, and its abdomen was much distended by the meal. Hence in less than eight hours one of these tiny wild beasts had attacked, overcome, and ravenously consumed two of its own species, each as large and heavy as itself" (*l. c.*, p. 174).

Shrews possess scent glands, secreting a strong, musky smelling liquid, which are situated on each side of the body near the fore leg. On account of their odor they are regarded as undesirable food by most mammals and are rarely eaten.

Specimens examined from Illinois and Wisconsin:

Illinois — Fox Lake, 3; Camp Logan, Lake Co., 8=11.

Wisconsin — Sumner, 2; Milton, Rock Co., 1; Solon Springs, Douglas Co., 13 (7 in alcohol); Sayner, Vilas Co., 17; Spread Eagle, Florence Co., 3; Beaver Dam, Dodge Co., 1; Conover, Vilas Co., 1; Lac Vieux Desert, Vilas Co., 5; (M.P.M.) Cataline, Marinette Co., 4; Newport, Door Co., 1; Prairie du Sac, Sauk Co., 4; Prescott, Pierce Co., 4; Kelly Brook, Oconto Co., 2; Milwaukee Co., 1; Delavan, Walworth Co., 1; (S. C.) Beaver Dam, Dodge Co., 20=80.

Sorex richardsonii Bachman.

Richardson's Shrew.

Sorex richardsonii Bachman, Jour. Acad. Nat. Sci. Phila., VII, Pt. II, 1837, p. 383. Miller, N. Amer. Fauna, No. 10, 1895, p. 48 (Minnesota). Merriam, N. Amer. Fauna, No. 10, 1895, p. 63 (Minnesota, etc.). Snyder, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 123 (Wisconsin). Jackson, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 30 (Wisconsin).

Type locality — Unknown; probably plains of Saskatchewan, Canada.

Distribution — From Wisconsin and western Ontario through Minnesota and Manitoba northwest to Alberta and northward nearly to the Arctic Circle; exact limits unknown.

Description — Color of back noticeably different from the sides; upper parts very dark brown; sides of body fulvous brown; under parts ashy plumbeous, more or less faintly washed with brownish; tail dark brown above, paler brown on under surface, the end blackish; 3rd unicuspid tooth decidedly larger than the 4th. All unicuspid teeth larger than in *S. fumeus* and brain-case and rostrum heavier.

In summer a nearly concolor brown pelage occurs hardly distinguishable from the brown pelage of *S. fumeus*.

Measurements — Total length, about 4.50 in. (114 mm.); tail vertebræ, 1.60 in. (41 mm.); hind foot, .56 in. (14 mm.).

Richardson's Shrew probably occurs throughout Wisconsin, but it is doubtful if its range extends quite so far south as Illinois. There are specimens in the Field Museum from Solon Springs, Douglas Co.; Sayner and Conover, Vilas Co.; and Pelican Lake, Oneida Co.; Jackson records 5 specimens taken southeast of Rhineland in Oneida Co. (*l. c.*, p. 30); Synder secured a specimen near Beaver Dam, Dodge Co. (*l. c.*, p. 123); and Mr. W. H. Osgood secured a specimen in brown pelage at Pelican Lake, Oneida Co., on September 20, 1911, which agrees perfectly in coloration with brown specimens of *S. fumeus*. The fact that so few specimens have been taken does not necessarily imply that the animal is rare, as all collectors know Shrews are by no means easy to trap and are scarcely ever seen unless found in some pit or well into which they have fallen.

Specimens examined from Wisconsin:

Wisconsin — Solon Springs, Douglas Co., 2; Pelican Lake, Oneida Co., 1; Sayner, Vilas Co., 1; Conover, Vilas Co., 1; (S. C.), Beaver Dam, Dodge Co., 1 = 6.

Sorex fumeus MILLER.

SMOKY SHREW.

Sorex fumeus MILLER, N. Amer. Fauna, No. 10, 1895, p. 50. RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 203 (Tennessee). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 142 (Wisconsin). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 66 (Tennessee, etc.).

Sorex richardsonii BAIRD, Mammals N. Amer., 1857, p. 24 (Racine, Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin).

Type locality — Peterboro, Madison Co., New York.

Distribution — Northeastern United States, Nova Scotia, southern New Brunswick, southern Ontario and southern Quebec, west to Wisconsin and south in the mountains to North Carolina, Tennessee and northern Georgia.

Description — General color dark slaty plumbeous; under parts slightly paler and more or less washed with ashy; tail dark above, with the

under surface pale (dull flesh color on fresh specimens) and the end blackish; under surface of muzzle whitish. The absence of a dark dorsal area is one of the characters by which this species may usually be distinguished from *richardsonii*. A brown pelage occurs in summer, the animal being near uniform dull chestnut brown or hair brown with under parts slightly paler. Third unicuspid tooth not smaller than the 4th, usually slightly larger; rostrum and brain-case lower and unicuspids smaller than in *S. richardsonii*.

Measurements — Total length, about 4.70 in. (120 mm.); tail vertebræ, about 1.75 in. (44.4 mm.); hind foot, .55 in. (13.7 mm.).

So far as known the only specimen of the Smoky Shrew which has yet been collected within our limits was taken at Racine, Wisconsin, and is now in the National Museum collection. The specimen was originally identified by Baird as *S. richardsonii*, but was later discovered by Miller to be *S. fumeus* (Miller, *l. c.*, p. 39).

Very little is known regarding the species and only a general idea of its distribution has been obtained from the widely scattered specimens which have been taken. The habits of this Shrew probably differ but little from those of allied species.

Sorex longirostris BACHMAN.

CAROLINA SHREW. SOUTHERN SHREW.

Sorex longirostris BACHMAN, Jour. Acad. Nat. Sci. Phila., VII, Pt. II, 1837, p. 370. MILLER, N. Amer. Fauna, No. 10, 1895, p. 52. MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 85. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 607 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 66 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 582 (McHenry Co., Illinois).

Amphisorex leseurii DUVERNOY, Mag. de Zool., Ser. 2, Mamm., 1842, p. 33 (Indiana).

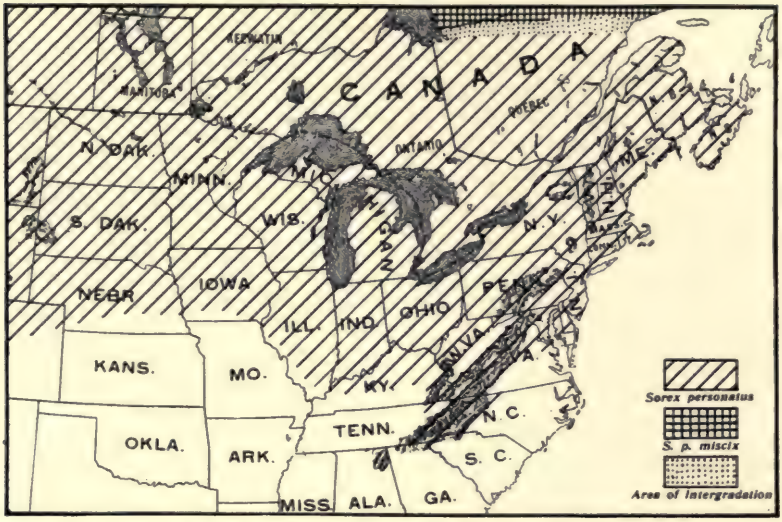
Type locality — Swamps of Santee River, South Carolina.

Distribution — North and South Carolina, northern Georgia, Tennessee and Kentucky to southern Illinois; limits of range unknown.

Description — General color dull chestnut brown, approaching sepia brown; under parts ashy gray, often washed with pale drab brown; fur slate colored at base; upper surface of tail dark, under surface pale; 3rd unicuspid tooth smaller than the 4th.

Measurements — Total length, about 3.45 in. (87 mm.); tail vertebræ, 1.25 in. (32 mm.); hind foot, .43 in. (10.50 mm.).

Remarks — Resembles *Sorex personatus* in coloration and size, although the tail and hind foot are somewhat shorter. They may always be distinguished by cranial and dental characters, the rostrum being decidedly broader and the 3rd unicuspid tooth is smaller than the 4th (see illustration, p. 408).



Maps illustrating the supposed distribution of Shrews belonging to the genus *Sorex* in eastern United States and Canada south of latitude 52°. The range of several of the species will probably be ultimately found to be much more extended.

Sorex personatus GEOFFROY ST. HIL. Type locality — Eastern United States. Description as previously given.

Sorex p. miscix BANGS. (Proc. N. Engl. Zoöl. Club, I, 1899, p. 15). Type locality —Black Bay, Strait of Belle Isle, Labrador. Larger and somewhat paler than *personatus*.

Sorex fontinalis HOLLISTER. (Proc. U. S. Nat. Mus., XL, 1911, p. 378.) Type locality — Cold Spring Swamp, near Beltsville, Maryland. Similar to *personatus* but smaller; skull smaller and narrower.

Sorex dispar BATCHELDER. (Proc. Biol. Soc. Wash., XXIV, 1911, p. 97.) Type locality — Beedes, Essex Co., New York. Color somewhat similar to *fumeus*, but tail much longer; also differs in cranial characters.

Sorex richardsonii BACHMAN. Type locality — Unknown, probably plains of the Saskatchewan. Description as previously given.

Sorex fumeus MILLER. Type locality — Peterboro, Madison Co., New York. Description as previously given.

Sorex longirostris BACHMAN. Type locality — Swamps of Santee River, South Carolina. Description as previously given.

Sorex fisheri MERRIAM. (N. Amer. Fauna, No. 10, 1895, p. 86, Pl. IV, fig. 4.) Type locality — Lake Drummond, Dismal Swamp, Virginia. Similar to *longirostris* but larger; hind foot longer. Color "dull chestnut brown fading to drab on under parts." (Merriam).

The Field Museum collection contains 7 specimens of the Carolina Shrew from extreme southern Illinois; 4 from Reevesville, Johnson Co., and 3 from Olive Branch, Alexander Co. Aside from these the only other specimen known to have been taken within our limits is that recorded by Wood, as identified by Merriam, which was caught in a tamarack swamp near Pistakee Bay, McHenry Co., November 14, 1907 (Wood, *l. c.*, p. 582).

The limits of its range are unknown, but it may be expected to occur throughout Illinois and perhaps in southern Wisconsin.

Its habits may be assumed to differ but little from those of *S. personatus*.

Specimens examined from Illinois:

Illinois — Reevesville, Johnson Co., 4; Olive Branch, Alexander Co., 3=7.

Genus **MICROSOREX** Coues.

Microsorex Coues, Bull. U. S. Geol. & Geogr. Surv. Terr., III, 1877, p. 646. Type *Sorex hoyi* Baird.

Size very small; functional unicuspid teeth in upper jaw having a distinct pigmented secondary cusp on the inner sides; 3d unicuspid exceedingly minute and wedged in between the 2d and 4th.

Dental formula: I. $\frac{4-4}{2-2}$, C. $\frac{1-1}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3}$=32.

Microsorex hoyi (BAIRD).

HOY'S SHREW. PIGMY SHREW.

Sorex hoyi BAIRD, Mammals N. Amer., 1857, p. 32 (Racine, Wisconsin). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). MILLER, N. Amer. Fauna, No. 10, 1895, p. 89 (Minnesota, etc.).

Sorex (*Microsorex*) *hoyi* MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 89 (Minnesota, etc.).

Type locality — Racine, Wisconsin.

Distribution — Northern United States and southern Canada south to Michigan, southern Wisconsin and New York, and considerably further south in the Allegheny Mountains; its western range extends nearly across the continent but its exact limits are unknown.

Description — General appearance somewhat resembling *S. personatus*, but tail decidedly shorter. Upper parts approaching sepia brown; under parts ashy gray or pale brownish gray, often washed with buff on throat and breast; upper surface of tail dark brown, under surface pale. Best distinguished from any of our species by dental characters. There are apparently only three unicuspid teeth present on each side of upper jaw; the third is wedged in between the 2d and 4th and is so exceedingly small that it requires the aid of a good lens to distinguish it at all and even then it is rarely visible from the outside. The canine and second and third upper incisors have a distinct pigmented secondary cusp near base on the inner sides.

Measurements — Total length, about 3.20 in. (81 mm.); tail vertebræ, 1.25 in. (31.8 mm.); hind foot, .42 in. (10.5 mm.).

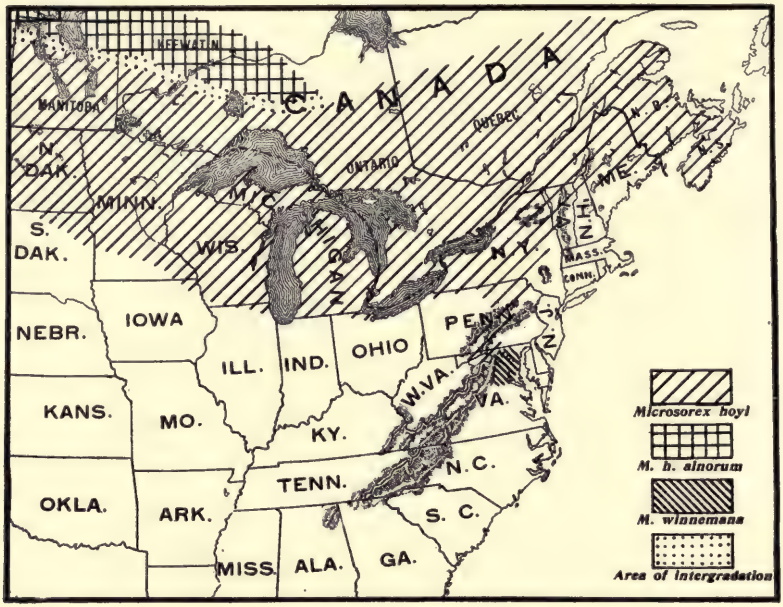
Hoy's Shrew was described by the late Prof. Baird, in 1857, from a specimen taken at Racine, Wisconsin. Two specimens, including the type, were recorded by him from that locality.

A mounted Shrew preserved in the Milwaukee Public Museum, which, taken by Thure Kumlien in Jefferson County, in 1879, was for many years supposed to be this species, but upon examination it proved to be *S. personatus;* therefore, until 1910 Baird's specimens were the only ones known to have been taken within our limits. In August, 1910, Mr. W. H. Osgood secured two others at Lac Vieux Desert, Vilas Co., Wisconsin. He informs me they were not taken in traps but had fallen into a partly excavated well some three or four feet deep, in which he found them. It is probable that the species is by no means rare, but the difficulty in trapping it makes it appear so.

Regarding the habits of this diminutive species we know very little. Like many others of its kind, its life history is one of Nature's books, which has rarely been opened, and which remains for future investigators to read.

Specimens examined from Wisconsin:

Wisconsin — Lac Vieux Desert, Vilas Co., 2.



Map illustrating approximate distribution of the Shrews belonging to the genus *Microsorex* in eastern United States and Canada.

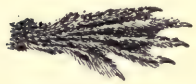
Microsorex hoyi (BAIRD). Type locality — Racine, Wisconsin. Description as previously given.

Microsorex alnorum (PREBLE). (N. Amer. Fauna, No. 22, 1902, p. 72.) Type locality — Robinson Portage, Keewatin, Canada. Grayer than *hoyi* above, without brownish on under parts; feet larger and also cranial differences; approaches very closely *Microsorex eximius* (Osgood).

Microsorex winnemana PREBLE. (Proc. Biol. Soc. Wash., XXIII, 1910, p. 101.) Type locality — Fairfax County (bank of Potomac River near Stubblefield Falls), Virginia. "Similar to *Microsorex hoyi*, but considerably smaller; braincase proportionally higher and more rounded" (Preble). Total length of type about 3.1 in. (78 mm.); tail vertebræ, about 1.2 in. (30 mm.).

Genus **NEOSOREX** Baird.

Neosorex Baird, Mammals N. Amer., 1857, p. 11. Type *Neosorex navigator* Baird.



Hind foot of *Neosorex palustris*.

Fourth upper incisor well developed; no secondary cusps on inner side of canines or incisors; braincase broad; *feet with fringe of bristly hairs.*

Dental formula: I. $\frac{4-4}{2-2}$, C. $\frac{1-1}{0-0}$, Pm. $\frac{2-2}{1-1}$, M. $\frac{3-3}{3-3}=32$.

Neosorex palustris (RICHARDSON).

MARSH SHREW. WATER SHREW.

Sorex palustris RICHARDSON, Zoöl. Jour., III, 1828, p. 517. MILLER, Proc. Bost. Soc. Nat. Hist., XXVI, 1894, p. 183 (Minnesota). *Ib.*, N. Amer. Fauna, No. 10, 1895, p. 45 (Minnesota).

Neosorex palustris JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 31 (Wisconsin). BAILEY, Rept. Orn. & Mamm., U. S. Dept. Agr., 1887, p. 435 (Minnesota).

Sorex (*Neosorex*) *palustris* MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 91 (Minnesota).

Type locality — Unknown; somewhere between Hudson Bay and Rocky Mountains.

Distribution — Ranges from Wisconsin, Minnesota and western Ontario to Hudson Bay, and northwest to the Great Slave Lake Region; replaced in the East by slightly different forms.

Description — General color of upper parts dusky seal-brown, almost black, showing a faint speckling of gray when closely examined; under parts ashy gray, showing a white gloss in some lights; inner sides of legs like belly; tail dark brown above and at the end; under surface of tail (except at the end) pale; feet *fringed with fine bristly hairs.*

Measurements — Total length, about 6 in. (153 mm.); tail vertebræ, 2.70 in. (68.5 mm.); hind foot, .77 in. (20 mm.).

So far as known, the range of the Marsh Shrew within our limits is confined to northern Wisconsin. There are specimens in the Field Museum collection from Douglas and Vilas counties and one in the Milwaukee Public Museum from Marinette County, and Jackson records four specimens from the vicinity of Rhinelander, Oneida Co.

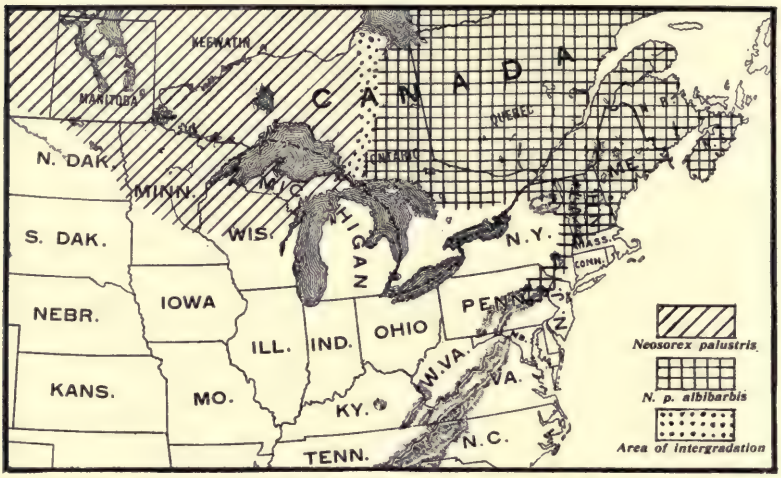
Very little is known regarding the habits of this species. It frequents the vicinity of water and is undoubtedly semi-aquatic, as it is a good swimmer and quite at home in the water. Mr. Vernon Bailey, who secured specimens at Elle River, Minnesota, says: "I have always found them living in holes in creek banks; in the spring of 1886 a neighbor caught and gave me one that he found swimming in a small pond of snow water in a hollow near his home" (*l. c.*, p. 435). Seton states that Prof. John Macoun has seen it swimming in the open waters of a mountain brook at Crow's Nest Pass, B. C. "It darted about swiftly in the current, without apparent effort, the snout and back only out."*

Samuel Hearne informs us that in the Hudson Bay Territories it is frequently found in Beaver houses in winter, "where they not only find a warm habitation, but also pick up a comfortable livelihood from the scraps left by the Beaver."†

* Life Hist. Northern Animals, II, 1909, p. 1115.

† Journey, 1795, p. 386.

Specimens examined from Wisconsin:
Solon Springs, Douglas Co., 4; Sayner, Vilas Co., 1; Lac Vieux Desert, Vilas Co., 3; (M.P.M.) Marinette Co., 1=9.



Map illustrating approximate range of the Shrews belonging to the genus *Neosorex* in eastern United States and southern Canada, south of latitude 52°.

Neosorex palustris (RICHARDSON). Type locality — Unknown; North America, somewhere between Hudson Bay and the Rocky Mountains. Description as previously given.

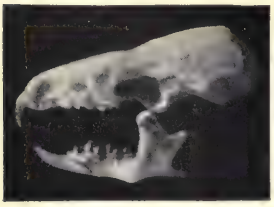
Neosorex albibarbis COPE. (Proc. Acad. Nat. Sci. Phila., 1862, p. 188.) Type locality — Profile Lake, New Hampshire. Resembles *palustris* in size and coloration of upper parts, but color of under parts is darker.

Genus **BLARINA** Gray.

SHORT-TAILED SHREWS.

Blarina Gray, Proc. Zoöl. Soc. Lond., 1837, p. 124. Type *Sorex talpoides* Gapper = *Sorex brevicaudus* Say.

Tail very short, less than one-third of total length; ears concealed by fur; teeth 30 or 32, tipped with reddish brown; unicuspids 4 or 5, first and second large, third and fourth much smaller, fifth very small or absent; first four unicuspids with small secondary cusp on inner side.



Skull of a Shrew (*Blarina*), enlarged.

Dental formula:

$$\text{I.}\ \frac{4-4 \text{ or } 3-3}{2-2},\ \text{C.}\ \frac{1-1}{0-0},\ \text{Pm.}\ \frac{2-2}{1-1},\ \text{M.}\ \frac{3-3}{3-3}$$

$$= 30 \text{ or } 32.$$

Subgenus **BLARINA** Gray.

"Teeth 32; unicuspids 5, the anterior 4 in two pairs, first and second largest and subequal, third and fourth abruptly much smaller and subequal, fifth minute. Basal lobe of middle incisor elongated anteroposteriorly. Brain-case not arched anteroposteriorly, highest at lambdoid suture; plane of occiput nearly flat." (Merriam.)

Blarina brevicauda (SAY).

SHORT-TAILED SHREW. MOLE SHREW.

Sorex brevicaudus SAY, Long's Exped. Rocky Mts., I, 1823, p. 164. KENNICOTT Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois).

Sorex Dekayi LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin).

Sorex Blarina (*brevicaudatus*) KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 93.

Sorex talpoides GAPPER, Zoöl. Journ., V, 1830, p. 202, Pl. VIII (Ontario).

Blarina brevicaudata ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 44 (Minnesota).

Blarina brevicauda STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). BAILEY, Rept. Orn. & Mamm., U. S. Dept. Agr., 1887, p. 435 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 132 (Indiana). MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 10 (Minnesota, Iowa, Missouri, Illinois, Michigan, Indiana). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 202 (Tennessee). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 122 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 74. JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 32 (Wisconsin). HAHN, Ann. Rept., Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 598 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 583 (Illinois).

Type locality — Near Blair, Washington Co., Nebraska.

Distribution — From Nebraska and Manitoba east to the Atlantic coast, north to southern Canada, south to northern Missouri, Illinois and Virginia and in the mountains to North Carolina and Tennessee.

Description — Upper parts dusky plumbeous, showing brownish plumbeous in some lights; under parts paler and more or less washed with ashy; tail short, dark above and somewhat paler below; four well developed unicuspid teeth, the first two larger than the third and fourth, the third and fourth about equal.

Measurements — Average measurements of 12 specimens from Wisconsin and northern Illinois: Total length, about 5 in. (125 mm.); tail vertebræ, about 1 in. (25.6 mm.); hind foot, .62 in. (15.9 mm.).

Short-tailed Shrew (*Blarina brevicauda*).

The Short-tailed Shrew occurs commonly throughout Wisconsin and northern Illinois, but it apparently intergrades with the smaller, southern race, *B. brevicauda carolinensis*, in the central part of the latter state. The average measurements, as given by Wood, of 39 specimens from Warren, Iroquois and Champaign counties are as follows: Total length, 4.49 in. (113 mm.); tail vertebræ, .90 in. (22.68 mm.).

The Short-tailed Shrew, or Mole Shrew as it is often called, makes its home under decayed logs and old piles of brush. It constructs tunnels and runways under leaves, moss and in loose soil, the burrows usually being shallow and near the surface of the ground. It is both nocturnal and diurnal and its food consists largely of slugs, worms and insects of various kinds, but it also eats flesh of other animals and does not hesitate to attack a Mouse larger than itself. According to Prof. E. D. Cope a Shrew has been known to attack and kill a snake two feet in length. He says: "I recently placed a water-snake (*Tropidonotus sipedon*) of two feet in length, in a fernery which was inhabited by a shrew, either a large *Blarina carolinensis* or a small *Blarina talpoides*. The snake was vigorous when placed in the case in the afternoon and bit at everything within reach. The next morning the glass sides of his prison were streaked with dirt and other

marks, to the height of the reach of the snake, bearing witness to his energetic efforts to escape. He was then lying on the eastern floor in an exhausted state, making a few ineffectual efforts to twist his body, while the Blarina was busy tearing out his masseter and temporal muscles. A large part of the flesh was eaten from his tail, and the temporal and masseter muscles and eye on one side were removed, so that the under jaw hung loose. . . . [The shrew] had apparently not been bitten by the snake and was uninjured. Whether the shrew killed the snake is of course uncertain, but the animus with which he devoured the reptile gives color to the suspicion that he in some way frightened him to exhaustion.*

Regarding the ability of this ferocious little animal to kill Mice, I will quote a statement of Dr. C. Hart Merriam, who says:

"Having caught a vigorous, though undersized Shrew, I put him in a large wooden box and provided him with an ample supply of beechnuts, which he ate eagerly. He was also furnished with a saucer of water, from which he frequently drank. After he had remained two days in these quarters, I placed in the box with him an uninjured and very active white-footed mouse. The Shrew at the time weighed 11.20 grammes, while the mouse, which was a large adult male, weighed just 17 grammes. No sooner did the Shrew become aware of the presence of the mouse than he gave chase. The mouse, though much larger than the Shrew, showed no disposition to fight, and his superior agility enabled him, for a long time, easily to evade his pursuer, for at a single leap he would pass over the latter's head and to a considerable distance beyond. The Shrew labored at great disadvantage, not only from his inability to keep pace with the mouse, but also, and to a still greater extent, from his defective eyesight. He frequently passed within two inches (31 mm.) of the mouse without knowing of his whereabouts. But he was persistent, and explored over and over again every part of the box, constantly putting the mouse to flight. Indeed, it was by sheer perseverence that he so harassed the mouse, that the latter, fatigued by almost continuous exertion, and also probably weakened by fright, was no longer able to escape. He was first caught by the tail; this proved a temporary stimulant, and he bounded several times across the box, dragging his adversary after him. The Shrew did not seem in the least disconcerted at being thus harshly jerked about his domicil, but continued the pursuit with great determination. He next seized the mouse in its side, which resulted in a rough and tumble, the two rolling over and over and biting each other with much energy. The mouse freed himself, but was so exhausted

* Amer. Nat., VII, 1873, pp. 490–491.

that the Shrew had no difficulty in keeping alongside, and soon had him by the ear. The mouse rolled and kicked and scratched and bit, but to no avail. The Shrew was evidently much pleased and forthwith began to devour the ear. When he had it about half eaten-off the mouse again tore himself free; but his inveterate little foe did not suffer him to escape. This time the Shrew clambered up over his back and was soon at work consuming the remainder of the ear. This being satisfactorily accomplished, he continued to push on in the same direction till he had cut through the skull and eaten the brains, together with the whole side of the head and part of the shoulder. This completed his first meal, which occupied not quite fifteen minutes after the death of the mouse. As soon as he had finished eating I again placed him upon the scale and found that he weighed exactly 12. grammes — an increase of .80 gramme.

"The Shrew was half an hour in tiring the mouse, and another half hour in killing him. But it must be remembered that he was not fully grown, and was doubtless, on this account, longer in capturing and killing his victim than would have been the case had he been an adult. Still, it is clear that a Shrew could never catch mice on open ground. His small size, however, enables him readily to enter their holes and to follow them to their nests and the remotest ramifications of their burrows, where, having no escape, he can slay them with fearful certainty."*

Regarding the habits of this species Robert Kennicott writes: "The short-tailed shrew abounds both in prairie and woods. I am unable to say whether it exists far out on the larger prairies; but it has been found in abundance several miles from any woodland. It is fond of high ground, and is not at all aquatic. I have been unable to find traces of it in wet places, such as swamps and the edges of sloughs, within a few rods of which it is numerous. I have nowhere seen more of its tracks than on some white-oak ridges lying several miles west of Lake Michigan. But even where most numerous, it is little known; and, indeed, it is no easy matter to get sight of one of them at any time. In turning over old logs, for hours, in search of them, I have rarely been able to see one; and then only when it was retreating at such speed as to generally escape in some of the numerous path-ways which lead in every direction from a log thus chosen for its resting place, or under which it may happen to take refuge on a journey by day. These, like other shrews, are often found lying dead on the ground, both in winter and summer, having been killed by birds or beasts of prey, and left uneaten on account of their disagreeable odor;

* Mamm. Adirondack Reg., 1886, pp. 166–168.

and such are usually the only specimens observed by farmers." (*l. c.*, p. 94.)

Dr. John T. Plummer of Richmond, Wayne Co., Indiana, gives a most interesting account of the habits of a captive animal of this species.* A specimen which he secured was put in a glass vessel five inches deep with perpendicular sides, which he covered with a book upon which was placed the vertebra of a horse. To his astonishment (as the book and bone together weighed upwards of a pound) the Shrew succeeded in pushing the covering sufficiently far to one side to enable it to escape from the jar. After being recaptured and placed in a box, it was given a number of pieces of rotton wood which it arranged to form a hiding place, leaving several openings for egress and ingress. Pieces of paper and rags were cut into small pieces by the animal and formed into a bed. At first the Shrew was shy but it soon learned to take a worm from the Doctor's fingers and would seize it so firmly that he informs us he was able to raise the little animal into the air by means of the worm. It was given flesh of all kinds, fish, coleopterous as well as other insects, corn, oats, and other kinds of grain, all of which appeared to be acceptable food. "The corcle of the grains of maize was always eaten out, as it is by rats and mice." When water was put into the box the Shrew "wet his tongue two or three times and went away; but when worms were dropped into the cup, he returned, waded about in the water, snatched up his victim, maimed it, stored it away, and returned repeatedly for more till all were secured." A full grown living Mouse was put into the box, which was at once fiercely pursued by the Shrew, attacked and killed. Another Mouse met with the same fate.

While there is little reason to believe that the bite of this Shrew is more toxic than that of any other of our small mammals, an instance is given by Mr. C. J. Maynard, where its effects were decidedly unpleasant. He states that while holding a Short-tailed Shrew, which he had caught, in his hand the animal bit him three times, the teeth making slight punctures in the skin barely sufficient to draw blood. He first noticed a burning sensation in the bitten fingers, which soon began to swell rapidly and the skin in the immediate vicinity of the punctures turned whitish. The burning sensation soon was accompanied by shooting pains extending to the elbow. The pains persisted with gradually lessening severity for a week and did not entirely subside for nearly a fortnight, or until the swelling had entirely disappeared.†

Very little is known regarding the breeding habits of this species

* Amer. Journ. Sci. & Arts, XLVI, 1844, pp. 237–240.

† Contributions to Science, I, 1889, p. 57–58.

and, so far as I am aware, nothing definite has been written except by Dr. Merriam, who says: "On the 22d of April, 1878, I found a couple of Shrews under a plank-walk near my museum. They proved to be a male and female, and the latter contained young which, from their size, would probably have been born early in May. Another female, caught near the same place, April 21, 1884, contained five large embryos which would certainly have been born within ten days. They weighed, together, 4.20 grammes. I procured a half grown young, February 10, 1884, which must have been born late in the fall. Hence two or three litters are probably produced each season. The young born in autumn do not breed in the spring following, as I have demonstrated by repeated dissections of both sexes" (*l. c.*, pp. 172–173).

Specimens examined from Illinois, Wisconsin and adjoining states:

Illinois — Chicago, 6; Fox Lake, Lake Co., skins, 16, in alcohol, 3; Camp Logan, Lake Co., 5; Galena, Jo Daviess Co., 2 = 32.

Michigan — Dowagiac, Cass Co., 4.

Minnesota — Aitkin, 1; Excelsior, 2 = 3.

Wisconsin — Beaver Dam, Dodge Co., 26; Solon Springs, Douglas Co., 5; Spread Eagle, Florence Co., 6; Lac Vieux Desert, Vilas Co., 2; Conover, Vilas Co., 1; (M.P.M.) Douglas Co., 2; Burnett Co., 1; Prescott, Pierce Co., 8; Maiden Rock, Pierce Co., 5; Milwaukee, 2; Milwaukee Co., 3; Delavan, Walworth Co., 7; Fountain City, Buffalo Co., 1; Prairie du Sac, Sauk Co., 48 = 149.

Blarina brevicauda carolinensis (BACHMAN).

CAROLINA SHORT-TAILED SHREW.

Sorex carolinensis BACHMAN, Journ. Acad. Nat. Sci. Phila., VII, Pt. 2, 1837, p. 366.

Blarina brevicauda carolinensis MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 13 (Kentucky, Tennessee, Indiana, etc.). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 74 (S. W. Missouri). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 202 (Tennessee). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 601 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 587 (Illinois).

Type locality — Eastern South Carolina.

Distribution — Southern United States (except Florida), north to Virginia, Illinois and Missouri, and west to Texas.

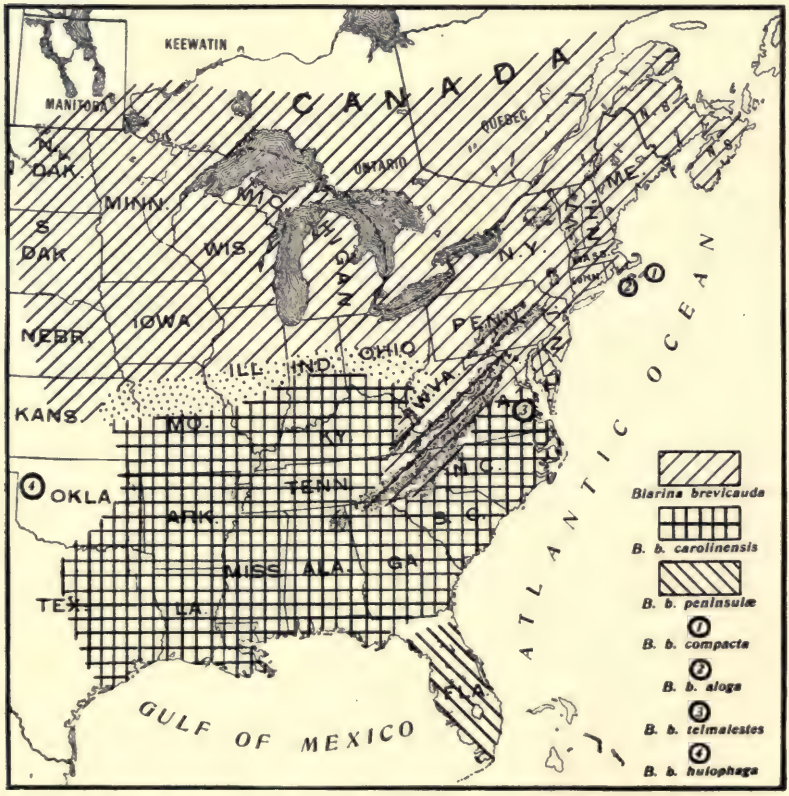
Description — Similar to *B. brevicauda*, but smaller and generally somewhat browner; general color dusky plumbeous, often tinged with brownish; under parts somewhat paler; teeth similar to *B. brevicauda*.

Measurements — Total length, about 4 inches or less, the average measurements of 20 specimens being 3.82 in. (97 mm.); tail vertebræ, about .80 in. (20 mm.); hind foot, .50 in. (12.7 mm.).

The Carolina Short-tailed Shrew replaces the northern form, *B. brevicauda*, in southern Illinois, probably intergrading with it in the south central part of the state. The Field Museum collection contains specimens from Alexander, Pope, Johnson and Hardin counties, and Howell records it from the vicinity of Shawneetown, Gallatin Co. (*l. c.*, p. 32.) Its habits, so far as known, are similar to those of *B. brevicauda*.

Specimens examined from Illinois:

Illinois — Olive Branch, Alexander Co., 29 (14 in alcohol); Golconda, Pope Co., 3; Reevesville, Johnson Co., 5; Rosiclaire, Hardin Co., 6 = 43.



Map showing approximate distribution of the Shrews belonging to the subgenus *Blarina* in eastern United States.

Blarina brevicauda (SAY). Type locality — Near Blair, Washington Co., Nebraska. Description as previously given.

Blarina b. carolinensis (BACHMAN). Type locality — Eastern South Carolina. Smaller than *brevicauda;* description as previously given.

Blarina b. compacta BANGS. (Proc. N. Engl. Zoöl. Club, III, 1902, p. 77.) Type locality — Nantucket, Nantucket Island, Massachusetts. Size about that of *aloga;* color slaty.

Blarina b. aloga BANGS. (Proc. N. Engl. Zoöl. Club, III, 1902, p. 76.) Type locality — West Tisbury, Martha's Vineyard, Massachusetts. Smaller than *brevicauda;* color pale brown.

Blarina b. talpoides (GAPPER). (Zoöl. Journ., V, 1830, p. 202, Pl. VIII.) Type locality — Between York and Lake Simcoe, Ontario, Canada. Slightly smaller but otherwise very similar to *brevicauda*, and not considered by the writer as worthy of recognition.

Blarina b. peninsulæ (MERRIAM). (N. Amer. Fauna, No. 10, 1895, p. 14.) Type locality — Miami River, Dade Co., Florida. Similar to *carolinensis*, but color more slaty and hind feet larger.

Blarina b. hulophaga ELLIOT. (Field Columb. Mus. Pub., Zoöl. Ser., I, 1899, p. 287.) Type locality — Dougherty, Washita River, Chickasaw Nation, Indian Territory. Smaller and paler than *brevicauda;* tail shorter.

Blarina b. telmalestes (MERRIAM). (N. Amer. Fauna, No. 10, 1895, p. 15.) Type locality — Dismal Swamp, Virginia. Similar to *brevicauda*, but more plumbeous; hind feet relatively longer; skull narrower.

Subgenus **CRYPTOTIS** Pomel.

Teeth 30; unicuspids 4, but the fourth usually minute (as in our species, *B. parva*, in which it is hardly visible); basal cusp of middle incisor rounded; brain-case highest anterior to lambdoid suture.

Blarina parva (SAY).

SMALL SHORT-TAILED SHREW.

Sorex parvus SAY, Long's Exped. Rocky Mts., I, 1823, p. 164.

Sorex eximius KENNICOTT, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 97 (Dekalb Co., Illinois).

Blarina eximius BAIRD, Mammals N. Amer., 1857, p. 52 (St. Louis, Missouri; Dekalb Co., Illinois).

Blarina exilipes EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 132 (Indiana).

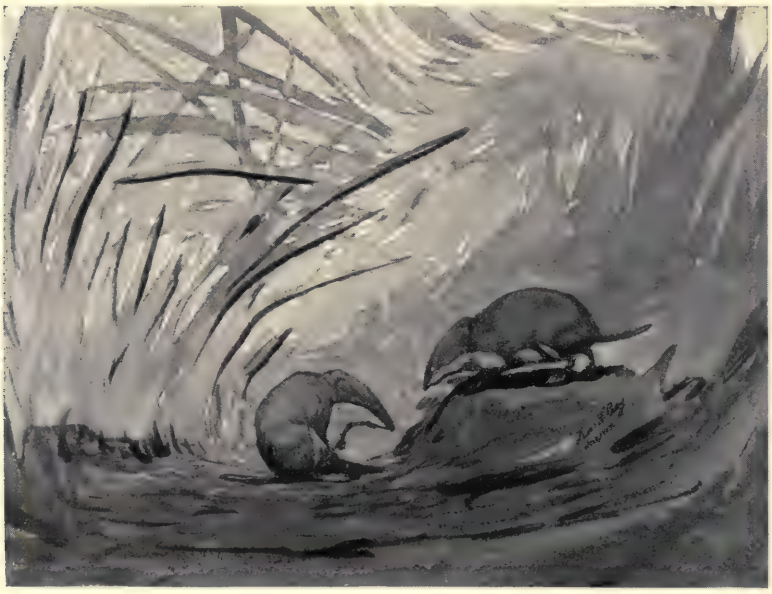
Blarina parva MERRIAM, N. Amer. Fauna, No. 10, 1895, p. 17 (Indiana, Nebraska, etc.). JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 74 (S. W. Missouri). RHOADS Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 202 (Tennessee). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 602 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 588 (Champaign and Mason counties, Illinois).

Type locality — West bank of Missouri River, near Blair (3 miles above mouth of Boyer River), Nebraska.

Distribution — Southern United States (except Florida); from Texas and Nebraska to the Atlantic coast, north to Illinois and Pennsylvania.

Description — Size very small; upper parts dark hair-brown, often approaching sepia brown; under parts dull ashy gray; tail dark brown above, the under surface like the belly; fourth upper unicuspid exceedingly small and at first glance apparently absent, difficult to see without a strong lense and then rarely visible from the outside.

Measurements — Total length, about 3.12 in. (79.4 mm.); tail vertebræ, .60 in. (16 mm.); hind foot, .40 in. (10.5 mm.).



Small Short-tailed Shrew (*Blarina parva*).

The Small Short-tailed Shrew is common in southern and central Illinois, and probably occurs nearly throughout the state, as it is recorded by Kennicott from Dekalb County. (*S. eximius*, *l. c.*, p. 97.) There are specimens in the Field Museum collection from Johnson, Alexander, and Hancock counties; Wood reports it from Mason and Champaign counties. I have also seen specimens from Charleston, Coles County, collected by Mr. T. L. Atkinson.

Comparatively little is known regarding its habits, although they probably differ but little from those of the larger species. It seems to prefer overgrown grassy localities. Hahn states that in Indiana all the specimens he collected were taken in "grassy places, usually where briars and shrubs were mingled with the grass, but never in the woods"

(*l. c.*, p. 604). Specimens have been taken in open woodland in southern Illinois in much the same localities as are frequented by *B. carolinensis*.

Specimens examined from Illinois:

Illinois — Olive Branch, Alexander Co., 10; Reevesville, Johnson Co., 2; Warsaw, Hancock Co., 3; (O.) Charleston, Coles Co., 2 = 17.

Map showing supposed range of the Small Short-tailed Shrews belonging to the subgenus *Cryptotis* in eastern United States.

Blarina parva (SAY). Type locality — West bank of Missouri River, near Blair (3 miles above mouth of Boyer River), Nebraska. Description as previously given.

Blarina floridana MERRIAM. (N. Amer. Fauna, No. 10, 1895, p. 19, Pl. I.) Type locality — Chester Shoal, 11 miles north of Cape Canaveral, Brevard Co., Florida. Similar to *parva*, but larger; also cranial differences.

Family TALPIDÆ. Moles.

The Moles are allied to the Shrews, but differ in having a zygomatic arch and audital bullæ, as well as in the form of the teeth. The last are white and not red-tipped as in our species of Shrews. The fur is soft and velvety; the eyes are very small and often rudimentary. There is no noticeable external ear; the fore feet are very large, being greatly modified for digging; and the neck is so short as to be apparently lacking. The sternum is provided with a well developed "keel" which supports the large pectoral muscle required on account of the burrowing habits of these animals; the cæcum is absent.

The members of the family are confined, so far as known, to the temporate regions of North America, Europe and Asia. Most of the species live in burrows in the ground and a few are semi-aquatic. Their food consists principally of insects, ants, worms, etc. Five genera and about 20 species and subspecies are found in North America, of which two genera, one species and one subspecies occur within our limits.

The European Mole (*Talpa europæa*) was the subject of much discussion by ancient naturalists. The earliest writers considered it to be a kind of blind Mouse but Topsell takes exception to this, stating that all Mice have "two longe crooked foreteeth which is not in Moles." He also says, "These beasts are all blind and want eies, and therefore came the proverbe, *Talpa cæcior tuphloteros alpalacos*, blinder than a Mole; to signifie, a man without all judgment, wit, or fore-sight; for it is most elegantly applyed to the minde, yet if any man looke earnestly upon the places where the eies should grow, he shall perceive a little passage, by drawing up the membrane or little skinne which is black, and therefore of them in this manner probably.

"All kinds of Moles want their sight, because they have not their eies open and naked as other beasts, but if a man pull up the skinne of their browes about the place of their eies, which is thicke and shawdoweth their sight, he shal perceive in them inward covered eies: . . . the young ones before birth have eies, but after birth, living continually in the darke earth without light, they cease to grow to any perfection; for indeede they neede them not."*

Proof of the antiquity of the proverb, "Even a worm will turn," is shown in Topsell's account of the habits of these animals. He says: "When the wormes are followed by Molds (for by digging and heaving

* Historie of Foure Footed Beastes, London, 1607, p. 499.

they fore-know their owne perdition) they flie to the superficies and very toppe of the earth, the silly beast knowing that the Molde their adversary, dare not follow them into the light, so that their wit in flying their enemy is greater, than in turning againe when they are troade upon" (*l. c.*, p. 500).

There was a curious ancient superstition in England concerning these animals to the effect that "if you whet a mowing syth in a fielde or meddow upon the feast day of Christs nativity, (commonly called Christmas day) all the Molles that are within the hearing thereof, will certainly for ever forsake that field, meadow or Garden."

Subfamily TALPINÆ.

KEY TO OUR GENERA.

End of muzzle with fringe of fleshy projections; tail more than 2 inches long; number of teeth 44. Genus CONDYLURA, p. 440.

End of muzzle without fringe of fleshy projections; tail about 1 inch long and nearly naked; fore feet very large; number of teeth 36. Genus SCALOPUS, p. 434.

Genus **SCALOPUS** Geoffroy.

Scalopus Geoffroy, Cat. Mamm. Mus. d'Hist. Nat., 1803, p. 77. Palmer, N. Amer. Fauna, No. 23, 1904, p. 620. Type *Scalopus virginianus* Geoffroy = *Sorex aquaticus* Linn.

Palate long; audital bullæ present; infraorbital foramen opening into a large, nearly horizontal aperture extending from above anterior end of zygoma; first upper incisor large, 2d and 3d very small; no functional lower canine; lower incisors 2; end of muzzle without fringe of fleshy projections; tail short and nearly naked; fore feet very large; hind feet webbed. The milk dentition is I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3}=40$.

Dental formula (adult): I. $\frac{3-3}{2-2}$, C. $\frac{1-1}{0-0}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3}=36$.

Scalopus aquaticus machrinus (RAFINESQUE).

PRAIRIE MOLE.

Talpa machrina RAFINESQUE, Atlantic Journal, I, 1832, p. 61.

Scalops argentatus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 97 (Illinois, etc.). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 653 (Illinois). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). ELLIOT, Field Columb. Mus. Pub., Zoöl. Ser., I, 1898, p. 220 (Iowa).

Scalops aquaticus MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 51 (Minnesota). EVERMANN & BUTLER Proc. Ind. Acad. Sci., 1893 (1894), p. 133 (Indiana).

Scalopus aquaticus machrinus JACKSON, Proc. Biol. Soc. Wash., XX, 1907, p. 74 (S.W. Missouri). *Ib.*, Bull. Wis. Nat. Hist. Soc., VII, 1910, p. 90 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 142 (Wisconsin). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 33 (Illinois, Missouri, Kentucky). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 589 (Illinois).

Scalops aquaticus machrinus HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 610 (Indiana). VAN HYNING & PELLETT, Proc. Iowa Acad. Sci., XVII, 1910, p. 215 (Iowa). EVERMANN & CLARK, Proc. Wash. Acad. Sci., XII, 1911, p. 33 (Indiana).

Type locality — Near Lexington, Fayette Co., Kentucky.

Distribution — From Kentucky and Ohio throughout Indiana, Illinois, Missouri, southern Michigan, southern Wisconsin to southern Minnesota, eastern South Dakota and Nebraska.

Skull of Prairie Mole.

Description — Fore feet and toenails enormously developed for size of the animal; pelage soft and "velvety"; general color slaty brown, somewhat paler on the under parts and often tinged with rusty; tail nearly naked; the largest of our Moles. The fore foot at its greatest width measures about three-quarters of an inch.

Measurements — Total length, about 6.75 in. (171.5 mm.); tail vertebræ, 1 to 1.10 in. (25 to 28 mm.); hind foot, about .95 in. (23 to 26 mm.).

Prairie Mole (*Scalopus aquaticus machrinus*).

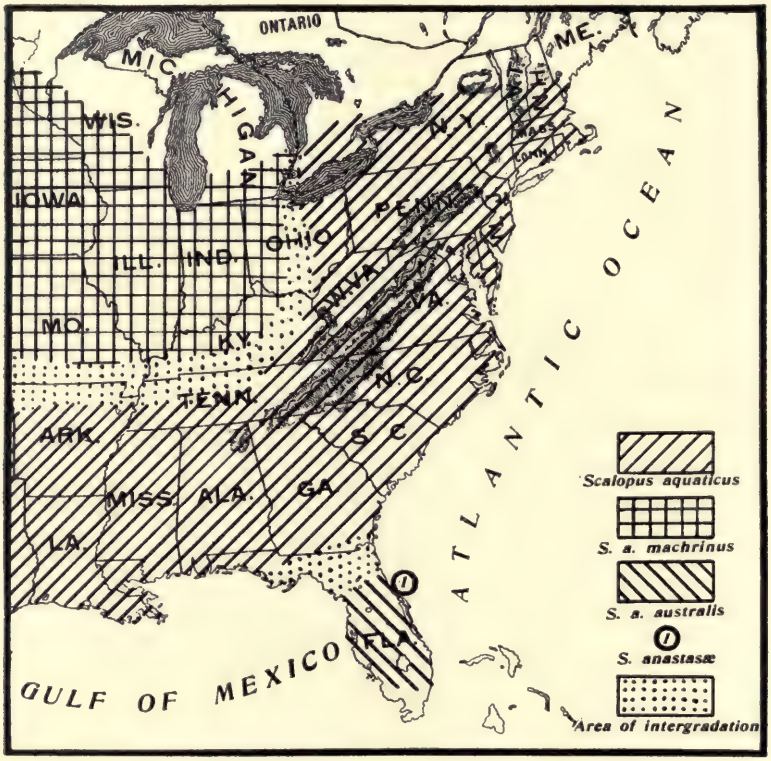
The Prairie Mole is common throughout Illinois and at least the southern half of Wisconsin, as I have examined specimens from Prescott County, and Hollister records it from Camp Douglas, Juneau Co. (*l. c.*, p. 142). It is quite common in the vicinity of Chicago and I have seen a dozen specimens taken in or near the city limits, including two from Jackson Park. Jackson states he saw what he assumed to be ridges made by this species at Galesville and Trempealeau, Trempealeau Co., Durand, Pepin Co., and Menomonie, Dunn Co. (*l. c.*, 1910, p. 90). From Illinois the Field Museum collection contains specimens from the northern, southern and western portions of the state. Wood reports it from Champaign County (*l. c.*, p. 589); Howell records it as common in Madison, Alexander, Jefferson, Richland and Pope counties (*l. c.*, 1910, p. 33).

The Prairie Mole is a burrowing animal and lives almost its entire life-time beneath the surface of the ground. Its huge fore feet are especially adapted for digging, enabling it to excavate subterranean galleries with ease. The results of its labors are often in evidence in lawns and gardens, in the shape of irregular ridges of earth which mark the course of its underground passages. The distance which under favorable conditions an animal of this species can dig in a single night is almost incredible. Audubon and Bachman state that one has been known to excavate a gallery several hundred yards in length, and Dr. Merriam informs us that he traced a fresh made burrow for nearly one hundred yards.* Moles are of decided benefit to the agriculturist, as their food consists largely of worms and insects of various kinds. They are also flesh eaters as well, and in captivity will eagerly eat fresh meat, but they are not vegetable feeders, although the depredations of Field Mice, which make use of their runways, are often unjustly laid at their door.

Regarding the habits of these animals Robert Kennicott says: "The proper food of this animal, like that of all other moles, is principally insects, in search of which, it passes along just below the surface, raising the earth so as to form a ridge, whereby its track is readily traced in summer, when it does not usually go beyond 2 or 4 inches deep for food, except in very dry weather — the insects lying mostly near the surface. Its habits in winter are not well known, though it is certainly active at this time, when it doubtless travels readily below the reach of frost, in search of food, to which depth some kinds of insects then descend. It appears incapable of enduring much cold, however, and, though one has been known to come to the surface occasionally during thaws in winter, it is never observed to come out in severe weather, as its hardy relatives, the shrews, habitually do.

* Mamm. Adirondack Reg., 1886, p. 155.

"The nest of this species is of considerable size, formed of soft grass, leaves, etc., the materials being sometimes carried by the moles for several rods under ground. It is situated in a chamber from 6 to 10 and even 18 inches below the surface, and is commonly under a log or stump, if in the woods. The chamber is approached by numerous



Map illustrating the approximate distribution of the Moles belonging to the genus *Scalopus* in eastern United States.

Scalopus aquaticus (LINNÆUS). (Syst. Nat., X ed., I, 1858, p. 53.) Type locality — Eastern United States. Color grayish brown; similar to *machrinus*, but smaller and averaging slightly darker; total length about 6.50 inches.

Scalopus a. machrinus (RAFINESQUE). Type locality — Lexington, Fayette Co., Kentucky. Total length about 6.75 inches; description as previously given.

Scalopus a. australis (CHAPMAN). (Bull. Amer. Mus. Nat. Hist., V, 1893, p. 339.) Type locality — Gainesville, Florida. Resembles *aquaticus* but is smaller and slightly browner; total length about 5.50 inches.

Scalopus anastasæ (BANGS). (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 212.) Type locality — Anastasia Island, near St. Augustine, Florida. About size of *australis*, but skull shorter and heavier; color golden brown.

converging galleries, some of which descend below the level of the chamber itself, entering it from beneath. Those roads which are most traveled by the moles are of larger size than those formed only in search of food.

"When a mole is liberated upon the ground, it does not attempt to run, but digs directly down, and will bury itself in a remarkably short time. When one is alarmed, while burrowing, it digs deeper.

"The number of young produced at a birth appears to be variable. The closely allied Scalops aquaticus was observed in one instance to bring forth five, and in another nine; and this species might be expected sometimes to be equally prolific. A gentleman of Winchester writes me that, in the latter part of February, he found a pair of moles, male and female, in their nest; and upon dissection, the female proved to be gravid with two young, fully formed, clothed with hair, and apparently about to be brought forth. A gentleman of Diamond Grove states that, as observed by him, the moles produce two or three young about the last of May; while at Beverly, Adams Co., they have been known to produce four about the 1st of July. If these informants have made no mistakes in their dates, this would indicate that at least two litters are produced in a year." (*l. c.*, pp. 98–99.)

Specimens examined from Illinois and adjoining states:

Illinois — Olive Branch, Alexander Co., 1; Rosiclaire, Hardin Co., 1; Chicago, 11; Warsaw, 9; Joliet, 1; Ozark, Johnson Co., 1 = 24.

Michigan — Dowagiac, Cass Co., 1.

Iowa — Knoxville, 1.

Wisconsin — (M. P. M.) Maiden Rock, Pierce Co., 3; Prescott, Pierce Co., 8; Fountain City, Buffalo Co., 3; Wyalusing, Grant Co., 4 = 18.

Parascalops breweri (BACHMAN), BREWER'S MOLE, is claimed to have been taken in Indiana, but so far as known its range does not extend so far west as Illinois. Regarding its occurrence in Indiana, Hahn says: "There are two specimens in the Indiana University Collection, correctly identified, catalogued and labelled as coming from Bloomington, Indiana. I do not place much credence in these labels and am not willing to record the species as occurring in the state on the basis of these specimens. But its occurrence is not beyond the range of probability."

Brewer's Mole resembles somewhat the Common Mole (*Scalopus*), the snout being simple without fleshy projections; but it may readily be distinguished by the number of teeth (44), and the cylindrical blunt tail, constricted at the base, and thickly covered with long hairs.

Genus **CONDYLURA** Illiger.

Condylura Illiger, Prodr. Syst. Mamm. et Avium, 1811, p. 125. Type *Sorex cristatus* Linn.

End of muzzle surrounded by numerous fleshy projections, "star shaped," the nostrils being in the center; tail comparatively long (about 2.75 in.) and thicker in the middle than at the base; second upper and third lower incisors very small; bullæ incomplete.

Dental formula: I. $\frac{3-3}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{4-4}{4-4}$, M. $\frac{3-3}{3-3}=44$.

Condylura cristata (LINN.).

STAR-NOSED MOLE.

[*Sorex*] *cristatus* LINNÆUS, Syst. Nat., X ed., I, 1758, p. 53.

Condylura cristata LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 338 (Wisconsin). KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois). *Ib.*, Agr. Rept. for 1857, U. S. Patent Office Rept., 1858, p. 101 (Illinois, etc.). THOMAS, Trans. Ill. State Agr. Soc., IV, 1859–60 (1861), p. 653 (Illinois). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). BAILEY, Rept. Orn. & Mamm., U. S. Dept. Agr., 1887, p. 435 (Minnesota). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 55 (Minnesota). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 32 (Wisconsin). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 130 (Michigan). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 613 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 583 (Illinois). JACKSON, Bull. Wis. Nat. Hist. Soc., VIII, 1910, p. 90 (Wisconsin).

Type locality — Pennsylvania.

Distribution — Eastern North America north to about latitude 51°, from Manitoba to the Atlantic coast, south to central Illinois and Virginia and in the Allegheny Mountains at least to North Carolina and Tennessee.

Description — End of muzzle surrounded by "star-shaped," fleshy projections; general color smoky brown, slightly paler below; tail more or less covered with blackish hairs; fore feet noticeably large, but smaller than those of the common Mole.

Measurements — Total length, about 7 in. (178 mm.); tail vertebræ, about 2.75 in. (70 mm.); hind foot with claw, 1.05 in. (26.5 mm.).

The Star-nosed Mole is found throughout Wisconsin and at least as far south as Edgar Co. in Illinois, although records for the state are by no means numerous. I have seen a specimen taken near Warsaw;

Star-nosed Mole (*Condylura cristata*).

Seton records it from western Illinois:* Kennicott, from Edgar and Cook counties; and Wood from Champaign County.

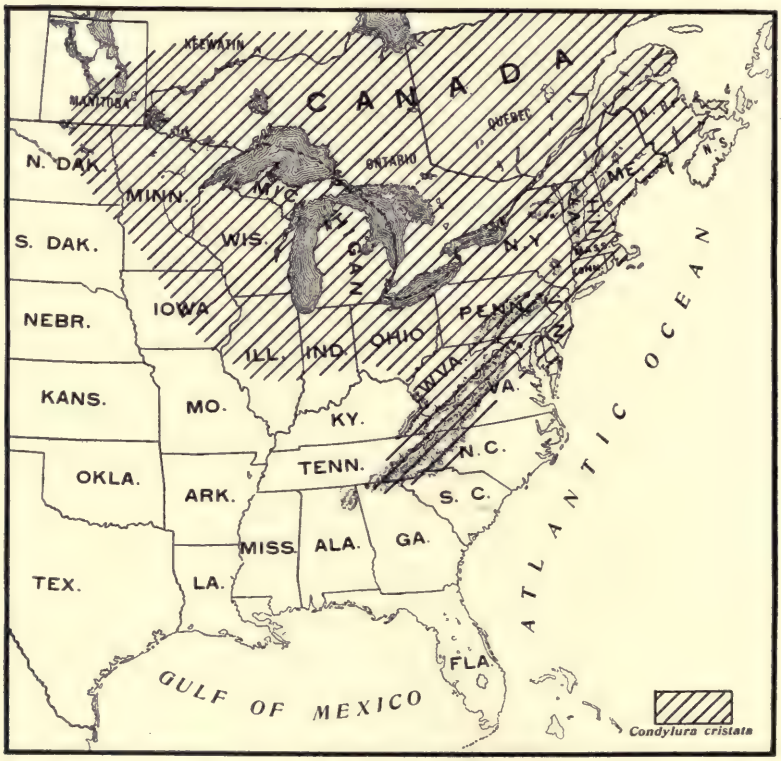
Wisconsin specimens have been examined from Newbold, Forest Co.; Medford, Taylor Co.; Merrill, Lincoln Co.; and there is a skull in the collection of Dr. H. V. Ogden from Mercer, Iron Co. Jackson records it from Stevens Point, Portage Co. (*l. c.*, 1908, p. 32); and from Whitcomb, Shawano Co., and Bayfield, Bayfield Co. (*l. c.*, 1910, p. 90).

This species prefers low meadows and marshy ground, although it also frequents dry localities where the soil is loose, such as gardens and ploughed fields. It is found more commonly, however, in the vicinity of water and according to various authors is a good swimmer and quite at home in the water. Dr. C. Hart Merriam says, "In gardens and ploughed ground they often work so near the surface that a ridge of loose earth is upheaved along the course of their tunnels. In meadows and pasture lands, on the contrary, the galleries are not marked by surface ridges, for the simple reason that they cannot

* Life Histories of Northern Animals, II. 1909, map, p. 1138.

readily force their way through the tough sod, but excavate their burrows immediately beneath. Late in the autumn, when the ground becomes frozen to the depth of two or three inches, the Moles sink their galleries into the soft earth below, and as winter advances they doubtless continue to deepen them sufficiently to avoid the frozen ground."*

Audubon and Bachman say: "In a few localities where we were in the habit, many years ago, of obtaining the Star-nosed Mole, it was always found on the banks of rich meadows near running streams. The galleries did not run so near the surface as those of the common Shrew Mole. We caused one of the galleries to be dug out, and obtained a nest containing three young, apparently a week old. The radiations on the nose were so slightly developed that until we carefully examined them we supposed they were the young of the common Shrew Mole. The nest was spacious, composed of withered grasses, and



Map illustrating supposed range of the Star-nosed Mole (*Condylura cristata*) in eastern North America.

* Mamm. Adirondack Reg., 1886, p. 146.

situated in a large excavation under a stump. The old ones had made their escape, and we endeavored to preserve the young; but the want of proper nourishment caused their death in a couple of days."*

A nest found by Dr. Merriam is described as being about two feet beneath the surface in clay soil and under a stump. "It was composed of grass, and from it a passage led to a vegetable garden near by" (*l. c.*, p. 151).

The food of the Star-nosed Mole is apparently about the same as that of the Prairie Mole. It lives largely upon insects and worms, but like the common species will eat Mice and meat in captivity.

Mr. Ernest Thompson Seton gives an interesting account of the habits of a captive animal of this species. He says:

"On July 7, 1909, at Cos Cob, Conn., I received an adult male Star-nosed Mole captured alive by a stream, not in the water, but running along a mossy bank.

"With the help of a commodious cage I made a number of observations. When put in deep water he swam swiftly and strongly. He progressed largely by the skulling action of his tail, but also swam with all four feet, striking alternately, never by striking with both hind-feet at once, as most truly aquatic quadrupeds do occasionally. He did not dive, and always endeavored to get out of the water as quickly as possible. * * *

"In the middle of each day he curled up and slept for two or three hours. At night he was very active.

"When given a pile of loose earth in which were many worms he showed great delight, and dived again and again through the pile, sometimes coming out with a worm, and suggested an Otter diving in a salmon river. * * *

"As soon as the above-named captive was caged, I gave him 12 grammes of common worms. He paid no heed for half an hour, but then aroused himself and fell on the worms with great demonstration, continually twiddling them with his 22 nose-fingers. Though avid, he ate them slowly, holding them with his fore-claws and tearing them up before devouring. In half an hour all were gone. This was at noon; at 1:45 he seemed ravenous again. I gave him a similar amount of worms, also 3 cutworm grubs; these latter he ignored while the former lasted. Towards night I gave the Mole about 2 ounces of raw beef, of which ⅓ only was lean, the rest fat. In the morning all the lean was eaten and all the fat rejected.

"Now a newly killed Deer-mouse was offered to him. He sprang on this with much demonstration and little effect. After twiddling it

* Quadrupeds of N. Amer., II, 1851, pp. 141–142.

all over, he began on the eyes and then ate the brains where the head had been crushed by the trap, turning back the skin. By next morning the Deer-mouse (it weighed more than the Mole) was devoured, except the skin, which was neatly turned inside out, and the bones—even the smallest ribs were left intact and quite clean. During the previous evening he ate also 8 grammes of worms. I found, however, that he preferred the large fat white grubs that are found under manure piles (*Lachnosterna fusca*); for these he neglected both worms and Mouse. A large blue wasp he would not touch; also a stag-beetle and he lived amicably together till the end. He refused several kinds of farinaceous food." †

The curious fleshy projections on the end of the snout, from which the animal has derived its name, are believed to possess highly sensitive, tactile functions.

Specimens examined from Illinois and Wisconsin:

Illinois — (O.), Warsaw, Hancock Co., 1.

Wisconsin — (M. P. M.), Newbold, Forest Co., 1; Medford, Taylor Co., 2; Merrill, Lincoln Co., 1; (O. C.), Mercer, Iron Co. (skull), 1 = 5.

† Life Histories of Northern Animals, II, 1909, pp. 1141–42–43.

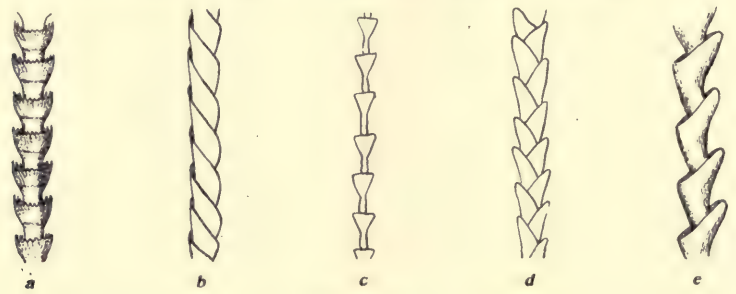
Order CHIROPTERA.

BATS.

The order is divided into two suborders: the *Megachiroptera* or Fruit-eating Bats, containing the Old World family *Pteropodidæ*, or so-called Flying Foxes; and the *Microchiroptera*, which includes the rest of the Bats and is the only one represented in North America.

Bats are flying mammals, being supplied with a leathery membrane supported by enormously elongated fingers and attached to the hind legs and sides of the body, which serves as a wing. In addition to the four elongated fingers supporting the wing membrane, there is a detached thumb or *pollex*, which projects from the upper margin and is provided with a hooked claw. From the inner side of the ankle joint projects a cartilaginous process called the *calcar*, which supports a portion of the membrane joining the legs and tail known as the interfemoral membrane. Another noticeable character in Bats belonging to the suborder *Microchiroptera* is the highly developed *tragus*, a process arising within the conch of the ear, which varies in shape and size in many species, and is often of diagnostic value. Noticeable peculiarities in the myology of these animals are found in the presence of a muscle, known as the *occipito-pollicalis*, extending from the occipital bone to the terminal phalanx of the pollex and in the divided sections of the *platysma*. Other important characters are: radius long and curved; ulna rudimentary; knee bending backward (owing to connection with the wing membrane); fibula rudimentary; mammæ thoracic; placenta discoidal and deciduate; testes abdominal or inguinal; cerebral hemispheres smooth and not extending backward over the cerebellum; presternum with noticeable "keel"; dental series including incisors, canines, premolars and molars; the number of teeth variable, but never more than 38; milk teeth unlike those of the permanent series. All Bats belonging to the suborder *Microchiroptera* have the crowns of the molars sharply tuberculate.

The hairs of Bats often show a decided difference in structural characters in members of different families. In some species of *Molossidæ*, for example, the hair when viewed under a powerful microscope shows zones or rings of verticulate spinules (Fig. *a*), while in many species belonging to the family *Vespertilionidæ* the spinules or scales are arranged in a continuous spiral (Fig. *b*), or in irregular imbricated triangles (Fig. *d*). Judging from a number of specimens I have examined, while the hairs of Bats belonging to allied species seem to be of the same general pattern, they are by no means alike and there is usually considerable variation even in hairs from the same animal.



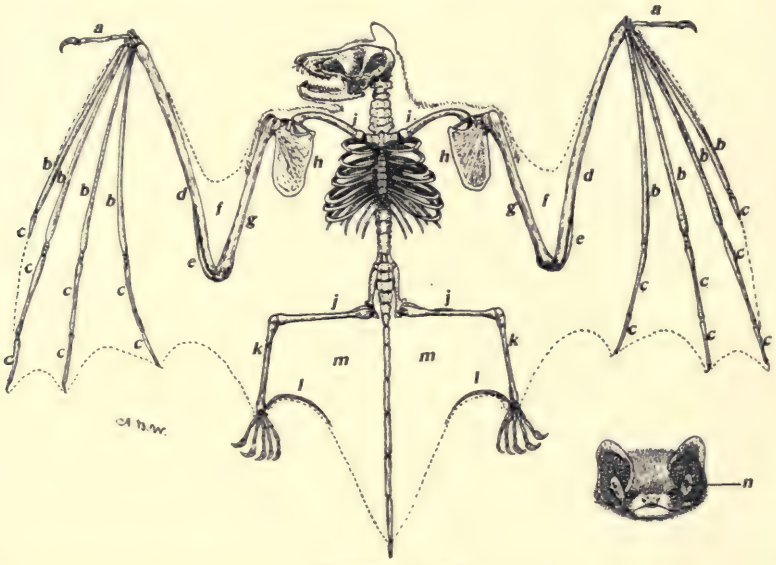
Hairs of Bats.

a, *Nyctinomus depressus;* b, *Pipistrellus subflavus;* c, *Myotis californicus;* d, *Lasionycteris noctivagans;* e, *Corynorhinus macrotis.* (Greatly enlarged.)

Bats differ widely in appearance and mode of life from other mammals and their place in Nature was a debatable question among the older naturalists. Aristotle defined them as birds with skinny wings; Pliny also considered them birds, although he states that the young are born alive and suckled by the mother. Later writers recognized them as mammals, but differed as to their classification. Linnæus ranked them with the Primates on account of the number of upper incisors (supposed at that time to be always 4), the thoracic position of the mammæ, the placental, uterine, and other anatomical characters. Prof. Huxley, however, later considered them to be merely greatly modified Insectivora but representing a well marked order, and his opinion has generally been accepted by modern zoölogists.

Bats are gregarious, nocturnal and crepuscular. They sleep most of the day gathered together in dark places, such as caves, hollow trees and in old buildings. When at rest they usually suspend themselves by the claws of their hind feet and hang head downward. They are unable to move about on the ground except with much difficulty, largely on account of the peculiar structure of their hind legs (the knee bending backward instead of forward), and when forced to do

so, they hitch themselves along clumsily and with evident effort. They vary greatly in size, from an animal smaller than a House Mouse to the great (for this family) *Pteropus edulis*, a species inhabiting Java and the Philippines and having a body the size of a small cat and a wing expansion of nearly five feet. Many species are supplied with odoriferous glands which are chiefly developed in the male. The food varies in different species; some are largely insectivorous; others frugivorous; and several exotic forms are sanguinivorous, but contrary to popular belief the last are all comparatively small. The so-called Vampire Bats belonging to the genus *Vampyrus*, which for many years were accused of sucking the blood of animals, are now known to confine themselves almost entirely to fruit.



Skeleton of a Bat.

a, Pollex; b, metacarpals; c, phalanges; d, radius; e, ulna; f, antebrachial membrane; g, humerus; h, scapula; i, clavicle; j, femur; k, tibia (fibula rudimentary and not shown); l, calcar; m, interfemoral membrane; n, tragus.

Bats possess a wonderfully developed tactile sense enabling them to avoid objects in their flight, which is not perfectly understood. It is supposed to be located in the highly sensitive network of nerves of the wing membrane,* as well as in the ear conchs, in the vibrissæ of the muzzle and in some species the cutaneous expansions surrounding the nostrils. Exceedingly slight changes in temperature or density of

* The wing membrane is furnished above and below with exceedingly fine and widely scattered hair, which, according to Schöbl, aid in transmitting the exalted sense of touch, while other nerve fibres give appreciation of temperature.

the air might readily be perceived and the walls of caves or branches of trees be thus avoided; but such an explanation seems hardly sufficient to account for the ability of blinded Bats to avoid, without actual contact, numerous silk threads stretched across a room, as claimed by Lazaro Spallanzani, whose often quoted experiments are worthy of repetition here.

Dr. Godman writes:* "In 1793 Spallanzani put out the eyes of a Bat, and observed that it appeared to fly with as much ease as before, and without striking against objects in its way, following the curve of a ceiling, and avoiding with accuracy everything against which it was expected to strike. Not only were blinded Bats capable of avoiding such objects as parts of a building, but they shunned, with equal address, the most delicate obstacles, even silken threads, stretched in such a manner as to leave just space enough for them to pass with their wings expanded. When these threads were placed closer together, the Bats contracted their wings, in order to pass between them without touching. They also passed with the same security between branches of trees placed to intercept them, and suspended themselves by the wall, etc., with as much ease as if they could see distinctly."

Dr. Joseph Schöbl† of Prague repeated Spallanzani's experiments and confirmed his results. Bats were kept for a year alive in his room, but instead of putting out their eyes he adopted a more humane method, the desired results being obtained by covering them with adhesive plaster.

The following account of similar experiments by Mr. A. Whitaker of Barnsley, England, is given by Millais:‡

"He obtained a Natterer's Bat and covered its closed eyes with wax, fastening it with a little patch of rubber and solution, and then released the Bat in a room in which it had not been before . . . . this blinded Bat at first flew in a hesitating manner, and then gaining confidence went straight towards the closed door. It stopped when about six inches away, and hovered slowly along the line of the top and right down the side, without doubt keeping its position through its sensitiveness to the slight draft which came through the tiny chink . . . . It flew quickly, passing under chairs of which there were twelve in the room, besides other furniture, and never even touched anything with the tips of its wings. An attempt to catch it showed that, although incapable of sight, it was well able to dodge, but it constantly stopped in its flight, hovered, and scratched at the covering

* Amer. Nat. Hist., I, 1826, p. 57.

† Amer. Nat., V, No. 3, 1871, pp. 174–175.

‡ Mamm. Great Brit. & Ir., I, 1904–6, pp. 96–97.

over its eyes. When a stick was held in its direct path, it avoided it when three or four inches away. When it wanted to rest it settled on one of the weights of a gas chandelier in quite an orthodox manner, and when a hand was stretched out to capture it, flew off again before it was touched."

Mr. Henry L. Ward tried similar experiments with another species (*Nyctinomus braziliensis*) in Mexico. He says: "With this species I various times repeated the experiment of Spallanzani made 200 years previous . . . my results were not equal to Spallanzani's, for although my bats certainly showed remarkable powers of detecting an approach to an object, yet they occasionally would strike against No. 18 wire. However, I fancy that had I like Spallanzani used silk threads, I should not have noted this; but the wire gave an audible record of each touch, no matter how light it was."*

While most of our Bats hibernate in winter, there is little doubt that a number of our tree-dwelling species migrate to a more or less extent in fall and spring. Dr. C. Hart Merriam has apparently proved this in regard to the Hoary Bat, *Nycteris cinereus*, and Silvery Bat, *Lasionycteris noctivagans*,† his evidence being largely based upon their occurrence far south of their breeding range in winter, and the appearance of the latter species in spring and fall at Mount Desert Rock, some 30 miles off the coast of Maine. Mr. Gerrit S. Miller, Jr., found Bats common on Cape Cod., Massachusetts, between August 21 and September 13, but apparently absent before and after that time,‡ which would seem to warrant the belief that they were migrating. The species observed were the Red Bat, *Nycteris borealis*, Hoary Bat, *Nycteris cinereus*, and Silvery Bat, *Lasionycteris noctivagans*. Dr. Edgar A. Mearns says concerning the Red Bat,§ "It is possible that the species migrates to the south in autumn and returns in the spring. During the latter part of October and the first week of November I have seen great flights of them during the whole day." Another account of the supposed migration of Bats is given by Mr. Arthur H. Howell,¶ in which he describes seeing Bats flying over Washington, D. C., on the morning of September 28, 1907, a hundred or more being observed between 9 and 10 o'clock. They were flying singly at a height varying from 150 to 400 feet (too far away to admit of the species being positively identified) and usually only four or five were in sight at one time.

* Trans. Wis. Acad. Sci., XIV, 1903 (1904), p. 642.

† Trans. Royal Soc. Canada, V, Sect. 4, 1888, pp. 85–87.

‡ Science, N. S., V, 1897, pp. 541–543.

§ Bull. Amer. Mus. Nat. Hist., X, 1898, p. 345.

¶ Proc. Biol. Soc. Wash., XXI, 1908, pp. 35–37.

In England, at least until a comparatively recent date, the common name for a Bat was Flitter-mouse, and in Germany, Fledermaus, literally meaning flying or flittering mouse, and names having a similar signification were, and still are, in use in many parts of Europe. In France their supposed relationship to mice is shown by the use of the name Chauve-souris.

Bats have always been more or less associated in folklore with witches and goblins, and have been the cause of much foolish superstition among the ignorant. In many parts of Europe, for example, their presence in a house was supposed to presage misfortune to the occupant; on the other hand, however, it is claimed that in China a similar intrusion is construed to be the forerunner of unusual good luck, thus favoring the Mongolian race, in a manner which seems hardly equitable.

The number of species belonging to this order is very great, representing at least 173 genera and 17 families, widely distributed throughout the world. Mr. Gerrit S. Miller, Jr., estimates that the recognized forms will eventually exceed 2,000.*

Suborder MICROCHIROPTERA.

The members of this suborder are nearly all insectivorous, although a few are sanguinivorous or frugivorous. They possess tuberculate molars; pollex with claw; second finger without claw and never with three phalanges, sometimes two are present, but usually one or none; palate not extending back of last molar; outer and inner edges of ear conch arising from separate points of origin. Sixteen families are now recognized belonging to this suborder, three of which occur in the United States, but only one so far as known is represented within our limits.†

* Bull. U. S. Nat. Mus., No. 57, 1907, p. 2.

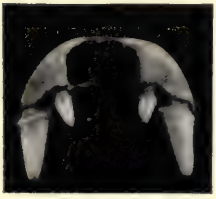
† The Free-tailed Bat, *Nyctinomus depressus*, belonging to the family *Molossidæ* has been taken in eastern Iowa.

Family VESPERTILIONIDÆ. Typical Bats.

This is by far the largest family belonging to the order. Its members are insectivorous, nocturnal and crepuscular; and are characterized by having the ears separate, with a small anterior basal lobe and tragi well developed. The muzzle is simple, without fleshy appendages (differing in this from the so-called Leaf-nosed Bats); tail attached to interfemoral membrane and extending to its edge or slightly beyond; clavicle present and well developed; radius long and curved; ulna rudimentary; pollex free from and extending beyond edge of wing membrane, ending with a hooked claw; presternum with prominent "keel" for the attachment of the large pectoral muscles; ribs much flattened and occasionally more or less anchylosed at their margins; cerebral hemispheres smooth; placenta discoidal and deciduate; mammæ thoracic; testes abdominal or inguinal. The milk teeth are unlike the permanent teeth and are usually replaced by the latter at an unusually early period, the cranial sutures become anchylosed and often disappear much earlier in life than in most of our mammals. The structural character of the hair is peculiar.*

Of the 100 or more North American species and subspecies, nine species belonging to 6 genera are known to occur within our limits, and it is probable that another genus and species (*Corynorhinus macrotis*) and possibly a representative of another family (*Nyctinomus depressus*) may ultimately be added to the list.

KEY TO THE GENERA.



Front view, showing upper incisors and canines much enlarged.

GROUP 1. Upper incisors (front teeth between canines) 2.

Upper surface of interfemoral membrane (membrane connecting tail with legs) completely furred; whole number of teeth 32. Genus NYCTERIS, p. 470.

Upper surface of interfemoral membrane entirely bare or furred slightly at extreme base; whole number of teeth 30. Genus NYCTICEIUS, p. 475.

* For remarks concerning the structural variation in the hair of Bats, see page 446.

Red Bat (*Nycteris borealis*). Hoary Bat (*Nycteris cinereus*).
Silvery Bat (*Lasionycteris noctivagans*).

Front view, showing upper incisors and canines much enlarged.

GROUP 2. Upper incisors (front teeth between canines) 4.

SECTION 1. Upper surface of interfemoral membrane furred from ⅓ to ½ its length, the rest bare.

Color sooty, frosted with white; whole number of teeth 36. Genus LASIONYCTERIS, p. 462.

Color yellowish brown; whole number of teeth 34. Genus PIPISTRELLUS, p. 465.

SECTION 2. Upper surface of interfemoral membrane entirely bare, or furred slightly at extreme base.

Ears less than .75 inch long; fur of back, when rubbed, showing decidedly darker at base; teeth in upper jaws 14; whole number of teeth 32. Genus EPTESICUS, p. 467.

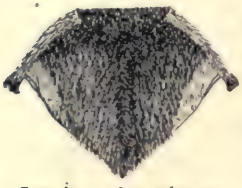
Ears less than .75 inch long; fur of back, when rubbed, not showing decidedly darker at base; teeth in upper jaw 18; whole number of teeth 38. Genus MYOTIS, p. 455.

Ears more than .75 inch long; teeth in upper jaw 16; whole number of teeth 36. Genus CORYNORHINUS, p. 476.

KEY TO SPECIES

KNOWN TO OCCUR WITHIN OUR LIMITS.

GROUP 1. Upper surface of interfemoral membrane (membrane connecting tail with legs) completely covered with fur.

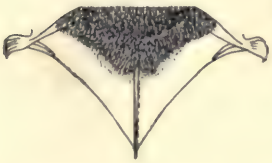


Interfemoral membrane.

Color of body hoary (brown mixed with grayish white); length about 5 inches; upper front teeth (incisors) between canines 2. HOARY BAT. *Nycteris cinereus*, p. 472.

Color of body on upper parts reddish brown or yellowish red brown; length about 4 to 4.25 inches; upper front teeth (incisors) between canines 2. RED BAT. *Nycteris borealis*, p. 470.

GROUP 2. Upper surface of interfemoral membrane (membrane connecting tail with legs) not completely covered with fur.



Interfemoral membrane.

SECTION 1. Upper surface of interfemoral membrane furred from ⅓ to ½ its length, the rest bare.

Color of body sooty brown or blackish, frosted with grayish white; length about 4 inches; whole number of teeth 36. SILVERY BAT. *Lasionycteris noctivagans*, p. 462.

Color yellowish brown; length about 3.40 inches; whole number of teeth 34. GEORGIAN BAT. *Pipistrellus subflavus*, p. 465.

SECTION 2. Upper surface of interfemoral membrane entirely bare, or furred slightly at extreme base; total length (nose to tip of tail) 4 or more inches.

Interfemoral membrane.

PART 1. Ears less than .75 inch long.

Color of body brown (generally slightly yellowish brown), paler below; ears less than .75 inch long; fur of back, when rubbed, showing decidedly darker brown at base; tip of tail extending slightly beyond the interfemoral membrane; number of teeth in upper jaw 14; whole number of teeth 32. BROWN BAT. *Eptesicus fuscus*, p. 467.

Color of body brown, paler below; ears less than .75 inch long; fur of back, when rubbed, not showing decided darker brown at base; number of teeth in upper jaw 18; whole number of teeth 38. GRAY BAT. *Myotis grisescens*, p. 459.

PART 2. Ears more than .75 inch long.

Ears very large, about one inch or more in length. The extraordinary size of the ears will distinguish this species. Not as yet recorded from within our limits, but may occur in southeastern Illinois. BIG-EARED BAT. *Corynorhinus macrotis*, p. 476.

SECTION 3. Upper surface of interfemoral membrane entirely bare, or furred slightly at extreme base; total length (nose to tip of tail) less than 4 inches.

PART 1. Upper incisors (front teeth between canines) 2.

Tail extending slightly beyond the interfemoral membrane; color dull umber brown above, paler below; fur decidedly darker at base; whole number of teeth 30. RAFINESQUE BAT. *Nycticeius humeralis*, p. 475.

PART 2. Upper incisors (front teeth between canines) 4; total length 3.75 inches or more.

Color of body brown, paler below; length of forearm 1.60 inches (40 mm.) or more. GRAY BAT. *Myotis grisescens*, p. 459.

PART 3. Upper incisors (front teeth between canines) 4; total length less than 3.75 inches.

Color brown, the fur much darker at base; ear when laid forward extending well beyond end of nose; tragus slender. SAY'S BAT. *Myotis subulatus*, p. 460.

Color brown, the fur much darker at base; ear when laid forward not extending beyond end of nose; tragus rather short and broad. LITTLE BROWN BAT. *Myotis lucifugus*, p. 455.

Subfamily VESPERTILIONINÆ.

Genus **MYOTIS** Kaup.

Myotis Kaup, Skizzirte Entw.-Gesch. u. Natürl. Syst. der Europ. Thierw., I, 1829, p. 106. Type *Vespertilio myotis* Bechstein.

Form rather slender; upper incisors 4; no fur on interfemoral membrane except at the extreme base. The dental formula will readily distinguish this genus from other North American genera belonging to this family.

Dental formula: I. $\frac{2-2}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{3-3}{3-3}$, M. $\frac{3-3}{3-3}=38$.

Myotis lucifugus (LECONTE).

LITTLE BROWN BAT.

V[espertilio] lucifugus LECONTE, McMurtrie's Cuvier Animal Kingd., I, Appendix, 1831, p. 431.

Vespertilio gryphus lucifugus H. ALLEN, Bull. U. S. Nat. Mus., No. 43, 1893, p. 80 (Cook Co. and Cairo, Illinois; Wisconsin; Isle Royale, Michigan).

Vespertilio lucifugus STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). RHOADS, Journ. Cin. Soc. Nat. Hist., XIX, 1897, p. 59 (Mammoth Cave, Kentucky). *Ib.*, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 203 (Tennessee).

Vespertilio gryphus EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 134 (Indiana).

Myotis lucifugus MILLER, N. Amer. Fauna, No. 13, 1897, p. 62 (Illinois, Kentucky, Minnesota, Ontario, etc.). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 126 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 32 (Wisconsin). *Ib.*, VIII, 1910, p. 90 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 621 (Indiana). ADAMS, Rept. State Board Geol. Surv. Mich., 1908 (1909) p. 390 (Isle Royale, Michigan). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 594 (Illinois).

Type locality — Georgia.

Distribution — Practically the whole of North America north of Mexico, except in the southwestern portion and on the Pacific coast; its northern range extends to Labrador, the Hudson Bay region and Alaska.

Description — General color dull brown (variable in shade); under parts paler, often tinged with yellowish, sometimes with gray; tragus bent slightly forward and not sharp-pointed; ***ear when laid forward not extending beyond end of nose.***

Measurements — Total length, about 3.60 in. (91 mm.); tail, 1.45 in. (37 mm.); hind foot, .40 in. (10 mm.); spread of wings (expanse), about 9 in.

Remarks — This species resembles *M. subulatus*, but differs in having a more rounded and less sharp-pointed tragus and shorter ears. In *M. subulatus* the ears when laid forward extend considerably beyond the end of the nose.

The known range of this species includes the whole of Illinois and Wisconsin. I have examined specimens from Hardin and Pope counties, Illinois; Miller records it from Warsaw and West Northfield (*l. c.*, p. 62); and H. Allen, from Cook and Alexander counties (*l. c.*, p. 80).

Specimens from Wisconsin are reported by Jackson from Dodge, Jefferson, Milwaukee, Rock and Waukesha counties (*l. c.*, 1908, p. 32), and he states the species is very abundant at Cassville, Grand Co., and along the Mississippi River (*l. c.*, 1910, p. 90); I have examined specimens from Dodge, Burnett, Polk, Rush and Pierce counties; and Dr. H. V. Ogden's collection contains specimens from Iron, Milwaukee, and Waukesha counties.

The Little Brown Bat is a natural cave dweller and is often found in great numbers in such places, especially in winter; but during its wanderings in summer it takes up its abode in almost any place which offers concealment, such as in a hollow tree, behind a window blind, or in a garret or outbuilding. I once found a dozen or more comfortably reposing behind a window blind which had remained closed for some time. Mr. W. E. Snyder states that in September, 1901, in Beaver Dam, Wisconsin, he found 60 Bats of this species in a granary, to which they had gained access through a broken window pane. They remained there three nights only, after which they were seen no more (*l. c.*, p. 126). Hahn states that in winter this species is found in enormous numbers in Wyandotte and other caves in southern Indiana (*l. c.*, p. 622), and they are known to frequent caves near Rosiclaire and elsewhere in southern Illinois.

In describing the habits of this species Stone and Cram say: "Most northern bats become thoroughly dormant in cold weather, and it has been stated, on good authority, that their daily sleep is, in reality, hibernation, differing from the sleep of other warm-blooded animals in the same manner that their winter hibernation does. But this probably only refers to certain species. The little brown bats that spend the days behind my blinds apparently only sleep in the ordinary way, as they frequently get to crowding and nudge and poke each other with their sharp bony elbows, becoming half awake and squeaking peevishly as they endeavor to arrange themselves more comfortably for the remainder of their nap. But this activity may be due to the increased irritability of the muscular fibre, which is said to be an in-

variable accompaniment of hibernation. When I threw open the blind last October, exposing them to the full glare of the afternoon sunlight, they maintained the same position and showed little sign of awakening, but half an hour later had disappeared, though the sun was still several hours high. This year the blinds were left open for the first part of the summer, and the bats were obliged to look up new sleeping quarters. In July I closed the blinds, hoping to entice the bats back to their former apartments; and, sure enough, about the first of the month I was delighted to see a solitary individual hanging by his toes on one corner of the window, fast asleep. Wishing to have him pose as model for an illustration, I unceremoniously routed him out and deposited him on my desk, where he spent a most unhappy morning, losing all patience with me before the portrait was half completed,— which was hardly to be wondered at, considering the circumstances. As often as I tried to get him to change his position, he would break forth into shrill stuttering protests and snap viciously at everything within reach; but he soon quieted down on being left alone, and slept complacently close to my hand while I sketched him. Several times he escaped and flew deliberately downstairs, which I think few birds would have the intelligence and coolness to do. All those that I have seen in similar circumstances fluttered helplessly against the glass or ceiling and absolutely refused to fly downward under any provocation; but my bat flew up or down with equal willingness, and from room to room, earnestly searching for a passage to the open air. Whenever he felt tired he would hang himself up in a fold of a curtain to rest, apparently being fast asleep as soon as he was fairly settled. Glass he soon learned to avoid as slippery and treacherous; but the mosquito screens furnished better foothold, and the way he would scuttle about over these was something marvelous. Finally I carried him outdoors and gave him his freedom, and, in spite of the sun, he seemed to find no difficulty in seeing, but started directly for the barn window, which was partly open, and entered it as the swallows did. No one seeing him at the time could reasonably have accused him of blindness; nor did the term 'blind as a bat' seem applicable when you caught the gleam and sparkle of his wicked little eyes, peering out from beneath his woolly eyebrows. He evidently decided that he had chosen an unsafe sleeping place, and for a little while the place was deserted; but in a few days I noticed a smaller specimen of his race in the opposite corner, and the day following there were nine of varying size ranged along the upper sash in their usual characteristic attitudes. One near the middle of the row was wide awake; washing himself after the manner of a cat, he

would lick his foot or a portion of his wing and rub his head with it the wrong way of the fur, and scratch himself rapidly behind the ear with one of his little thumb nails at the bend of his wing, the long bone of his fore-arm beating a tattoo on the glass beside him as he did so. The elasticity of the wing membrane is truly astonishing; he would seize an edge of it in his mouth and stretch it into all kinds of grotesque shapes in his endeavor to get it clean enough to suit his fancy, and sometimes, when at work on the inside, he would wrap his head up in it entirely, the thin rubbery stuff conforming to the general outline of his skull in the most startling manner."*

On alighting a Bat attaches itself to the object by its wing hooks (*pollex*) and hind feet, with its head up. If it intends to rest for any

Map showing range of the Little Brown Bat, (*Myotis lucifugus*) in eastern United States and southern Canada; its northern range extends to Labrador, the Hudson Bay region and Alaska.

* American Animals, 1902, pp. 197–199.

length of time, it turns head downward and hangs by the hooked nails of its hind feet. Its food, so far as known, consists entirely of insects.

Specimens examined from Illinois, Wisconsin and adjoining states:
Illinois — Rosiclaire, Hardin Co., 7; Golconda, Pope Co., 3 = 10.
Indiana — Wyandotte, 14.
Wisconsin — Beaver Dam, Dodge Co., 2; (M. P. M.) Burnett Co., 1; Fountain City, Buffalo Co., 25; Osceola, Polk Co., 1; Maiden Rock, Pierce Co., 11; Milwaukee, 2; (O. C.) Iron Co., 1; Milwaukee 2; Delafield, Waukesha Co., 1 = 46.

Myotis grisescens HOWELL.

GRAY BAT.

Myotis grisescens HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 46. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 625 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 67 (Tennessee, Missouri, Indiana).

Myotis velifer MILLER, N. Amer. Fauna, No. 13, 1897, p. 56 (in part specimens from Marble Cave, Missouri). HAHN, Proc. U. S. Nat. Mus., XXXV, 1908 (1909), p. 580 (Monroe Co., Indiana).

Type locality — Nickajack Cave, near Shellmound, Marion Co., Tennessee.

Distribution — Limits of range unknown. It has been taken in Tennessee, Indiana, Illinois and Missouri, and will probably be found ultimately in many of our Southern states.

Description — General color dull brown to mouse-gray, somewhat paler and more grayish below, flanks and lower portion of abdomen showing a slight buffy tinge in some specimens; whole number of teeth in upper jaw 18; tragus long and rather slender, similar to that of *velifer*.

Measurements — Total length, about 4.12 in. (97 to 110 mm.); tail, 1.65 in. (42 mm.); foot, .50 in. (10.5 mm.); forearm, 1.60 in. (40 mm.) or more; extent (spread of wings), about 11 in. (280 mm.).

Remarks — Differs from *M. velifer* in averaging darker in color and having the wing membrane attached to the feet near the ankle joint and not at the base of the toes as in *velifer*.

Very little is known concerning the range of this species, but it has so far been taken in Illinois, Tennessee, Missouri and Indiana. Mr. Howell described it as a new form in 1909, and specimens which have

been taken in Indiana and Missouri prior to that date were supposed to be *M. velifer*. It is common in the caves near Rosiclaire, Hardin Co., Illinois, and it will probably be found to occur in other suitable localities in at least the southern portion of the state.

Specimens examined from Illinois:
Illinois — Rosiclaire, Hardin Co., 36 (27 in alcohol).

Map showing known range of the Gray Bat (*Myotis grisescens*). It is probable that it occurs in several of our Southern states.

Myotis subulatus (SAY).

SAY'S BAT.

V[espertilio] subulatus SAY, Long's Exped. Rocky Mts., II, 1823, p. 65 (foot note)
Myotis subulatus MILLER, N. Amer. Fauna, No. 13, 1897, p. 76 (Illinois, Indiana Wisconsin, Kentucky, Missouri, etc.). HAHN, Ann. Rept. Dept. Geol. & Nat Resources Ind., 1908 (1909), p. 623 (Indiana). ADAMS, Rept. State Board Geol. Surv. Mich., 1908 (1909) (Isle Royale, Michigan). N. A. WOOD, 13th Rept. Mich. Acad. Sci., 1911, p. 134 (Charity Islands, Saginaw Bay, Michigan).
Vespertilio subulatus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 337 (Wisconsin). MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan). ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 36 (Minnesota). MILLER, Proc. Bost. Soc. Nat. Hist., XXVIII, 1897, p. 39 (Ontario).

Type locality — Arkansas River near La Junta, Colorado.

Distribution — North America, from the Atlantic to the Rocky Mountains, north to northern Quebec and Manitoba and south to Georgia.

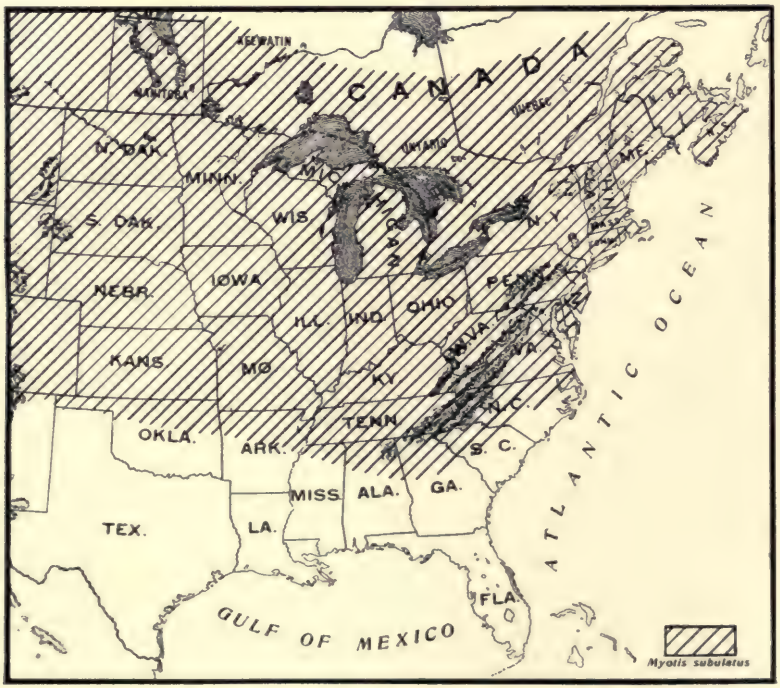
Description — Size small; color similar to *M. lucifugus;* general color

dull brown (variable in shade), under parts paler; fur often tipped with pale cinnamon brown or brownish buff; *ears when laid forward extending clearly beyond end of nose;* tragus slender, bent slightly backward or straight.

Measurements — Total length, about 3.40 in. (80 to 90 mm.); tail, 1.45 in. (37 mm.); foot, .32 in. (8 mm.).

Remarks — This species resembles *M. lucifugus*, but may be distinguished by its longer ears and more pointed tragus.

The range of this species includes the whole of Illinois and Wisconsin, but so far as known the only actual records for either state are given by Miller; one from Chicago, Illinois, and the other from Bayfield, Wisconsin. It is probably not uncommon, but has been overlooked on account of its general resemblance to *M. lucifugus.* The species is included in lists of Wisconsin mammals by both Lapham and Strong,



Map illustrating supposed range of Say's Bat (*Myotis subulatus*) in North America.

but no definite localities are given. Hahn states that it occurs throughout Indiana; Adams records it from Michigan; Herrick from Minnesota; and Allen from Iowa.

So far as known, its habits are similar to those of the Little Brown Bat, which it closely resembles.

Genus **LASIONYCTERIS** Peters.

Lasionycteris Peters, Monatsb. K. Preuss. Acad. Wiss. Berlin, 1865 (1866), p. 648. Type *Vespertilio noctivagans* LeConte.

Skull somewhat flattened; rostrum broad; ears short and broad; tragus straight and blunt (not pointed); interfemoral membrane furred on upper surface for about half its length.

Dental formula: I. $\frac{2-2}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{2-2}{3-3}$, M. $\frac{3-3}{3-3}=36$.

This genus is peculiar to North America and, so far as known, is represented by a single species.

Lasionycteris noctivagans (LECONTE).

SILVER-HAIRED BAT. SILVERY BAT.

V[espertilio] noctivagans LECONTE, McMurtrie's Cuvier Animal Kingd., I, 1831, p. 431.

Vespertilio noctivagans LAPHAM, Trans. Wis. State Agr. Soc., 1852 (1853), p. 337 (Wisconsin).

Vespertillio noctivagans KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 578 (Cook Co., Illinois).

Scotophilus noctivagans ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). STRONG, Geol. Wis., Surv .1873–79, I, 1883, p. 437 (Wisconsin).

Lasionycteris noctivagans H. ALLEN, Bull. U. S. Nat. Mus., No. 43, 1893, p. 105 (Illinois). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 34 (Minnesota). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 134 (Indiana). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 205 (Tennessee). MILLER, N. Amer. Fauna, No. 13, 1897, p. 86. SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 126 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 32 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 627 (Indiana). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 574 (Illinois). N. A. WOOD, 13th Rept. Mich. Acad. Sci., 1911, p. 134 (Charity Islands, Saginaw Bay, Michigan). *Ib.*, Mich. Geol. & Biol. Surv., Pub. IV, 1911, p. 312 (Michigan).

Type locality — Eastern United States.

Distribution — Greater portion of North America, from the Atlantic to the Pacific, north to Quebec, the Hudson Bay region and southern Alaska; south to California, Colorado, Tennessee and Georgia.

Description — Ears short and broad; general color sooty brown; the back, more or less of the under parts and the furred portion of the interfemoral membrane frosted with ashy white, the white frosting most pronounced on the back; interfemoral membrane furred for about half its length, the rest bare; teeth 36; four front teeth between canines in upper jaw; tragus short and bluntly rounded at the tip.

Measurements — Total length, about 4 in. (101.6 mm.); tail, 1.62 in. (41 mm.); foot .33 in. (8 mm.).

This species ranges throughout Illinois and Wisconsin and is common about Chicago. I have examined specimens from Chicago and other localities in Cook and Du Page counties; it has been reported from the Illinois River and St. Louis, Mo. (H. Allen, *l. c.*, p. 111); Wood states it is common in Champaign County (*l. c.*, p. 595).

Wisconsin specimens have been examined from Milwaukee, Walworth, Burnett, Polk and Dodge counties; Snyder reports it abundant at Beaver Dam, Dodge Co. (*l. c.*, p. 126); and Jackson gives it as very common in most localities in the southern part of the state (*l. c.*, p. 33).

The Silver-haired Bat is found practically throughout the United States and is enormously abundant in some localities. Harrison Allen states that an old house at Seneca Point, near Charlestown, Cecil Co., Md., was inhabited by more than 10,000 Bats supposed to be mostly this species, 9,640 of which were killed by actual count.*

In describing their habits Dr. C. Hart Merriam says: "Like many other bats, it has a decided liking for water ways, coursing up and down streams and rivers, and circling around lakes and ponds. In some places its habit of keeping directly over the water is very marked. At Lyon's Falls it is exceedingly abundant, particularly just below the falls. I have stood, gun in hand, on a point on the east bank of the river, and have seen hundreds passing and repassing, flying over the water, while during the entire evening not more than two or three strayed so far that if shot they would fall on the land. Several that were wounded and fell into the water, at a distance of fifteen or twenty feet from the bank, swam ashore. They swam powerfully and swiftly, for the current is here quite strong and would otherwise have carried them some distance down stream.

"Next to water courses, the borders of hard-wood groves are the favorite haunts of the Silver-haired Bat. By standing close under the edge of the trees one sees many that at a little distance would pass

* Monograph Bats N. Amer., 1864, p. xvii.

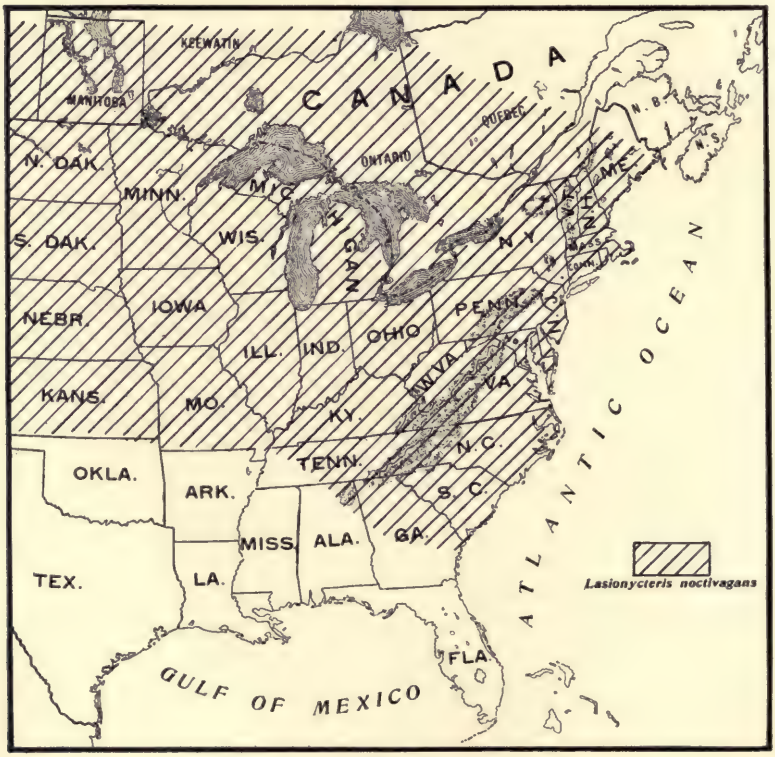
unobserved. While searching for their insect prey they may be seen to dart in and out among the branches and to penetrate, in various directions, the dense mat of foliage overhead. They often pass within a few inches of one's face, and yet it is rare that a sound is heard from their delicate wings."*

The nest is commonly in a hollow tree and, according to Merriam, the young are generally two in number and are born about the first of July. They commence to fly when about three weeks old (*l. c.*, p. 190).

Specimens examined from Illinois and Wisconsin:

Illinois — Glen Ellyn, Du Page Co., 1; Chicago, 7; Palos Park, Cook Co., 1=9.

Wisconsin — (M. P. M.) Milwaukee, 9; Delavan, Walworth Co., 1; Burnett Co., 1; Osceola, Polk Co., 4=15.



Map illustrating approximate range of the Silver-haired Bat (*Lasionycteris noctivagans*) in eastern North America.

* Mamm. Adirondack Reg., 1886, p. 188.

Genus **PIPISTRELLUS** Kaup.

Pipistrellus Kaup, Skizzirte Entwick-Gesch. u. Natürl. Syst. d. Europ. Thierw., I, 1829, p. 98. Type *Vespertilio pipistrellus* Schreber.

Ears tapering; tragus nearly straight; about one-third of interfemoral membrane sparsely furred, the terminal two-thirds bare; mammæ, 2.

Dental formula: I. $\frac{2-2}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{2-2}{2-2}$, M. $\frac{3-3}{3-3}=34$.

A single species belonging to this genus occurs within our limits.

Pipistrellus subflavus (F. CUVIER).

GEORGIAN BAT.

V[espertilio] subflavus F. CUVIER, Nouv. Ann. Mus. d'Hist. Nat. Paris, I, 1832, p. 17.
Vesperugo georgianus TRUE, Proc. U. S. Nat. Mus., VII, 1884 (1885), p. 602.
Vesperugo carolinensis EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 135 (Indiana). H. ALLEN, Bull. U. S. Nat. Mus., No. 43, 1893, p. 121 (not *Vespertilio carolinensis* Geoff.) (Cairo, Illinois). RHOADS, Journ. Cincin. Soc. Nat. Hist., 1897, p. 60 (Kentucky).
Pipistrellus subflavus MILLER, N. Amer. Fauna, No. 13, 1897, p. 92 (Missouri, Tennessee, etc.). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 629 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 67 (Tennessee). *Ib.*, XXIII, 1910, p. 33 (Missouri, Illinois, Kentucky). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 595 (Illinois). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VIII, 1910, p. 31.
Scotophilus georgianus STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin).

Type locality — Eastern United States—Supposed to be Georgia.
Distribution — Eastern United States, from southern New York and Illinois south to the Gulf states and west to Missouri and eastern Texas.

Description — Size small; basal third of interfemoral membrane sparsely covered with fur, the terminal two-thirds bare; general color yellowish brown (more or less variable), paler on under parts; tragus long, narrow and tapering.

Measurements — Total length, about 3.35 in. (85 mm.); tail, 1.58 in. (40 mm.); foot, .30 in. (7.5 mm.).

This species is common in southern Illinois and probably occurs throughout the greater portion of the state, although thus far it has not been recorded from the northern part. The Field Museum col-

lection contains a number of specimens from Hardin, Alexander, Pope, and Johnson counties, and I have seen a specimen from Coles County; Howell records it from Alexander, Union, Richland and Johnson counties (*l. c.*, 1910, p. 33); Wood says there are sixty-nine Bats of this species in the collection of the Illinois State Laboratory of Natural History at Urbana, Champaign Co., but all are without locality data (*l. c.*, p. 596).

Strong includes this species in his list of Wisconsin mammals (*l. c.*, p. 438), but merely gives the name without information as to locality or date of capture, a most unsatisfactory way to treat the first record for a state. Hollister questions this record and says the species is not

Map showing the probable range of the Georgian Bat (*Pipistrellus subflavus*) in the United States.

entitled to a place in a Wisconsin list (*l. c.*, p. 31), an opinion with which, in so far as the record in question is concerned, I most heartily concur.

Like others of our Bats it is strictly insectivorous. It frequents caves when available during the winter. The number of young varies from one to three. Hahn says, "mating takes place about the end of November and the young are probably born in July. The single pregnant female which I have examined contained three very small embryos on the 6th of June" (*l. c.*, p. 630).

Specimens examined from Illinois:

Illinois — Rosiclaire, Hardin Co., 14 (5 in alcohol); Olive Branch, Alexander Co., 5; Golconda, Pope Co., 10 (8 in alcohol); Ozark, Johnson Co., 1; (O.) Charleston, Coles Co., 1=31.

Genus **EPTESICUS** Rafinesque.

Eptesicus Rafinesque, Annals of Nature, 1820, p. 2. Type *Eptesicus melanops* Rafinesque. Miller, Bull. U. S. Nat. Mus., I, No. 57, 1907, p. 208.

Ears rather thick and leathery; tragus broadest near the middle and tapering to a point; rostrum more or less flattened; nares and palatal emargination not noticeably enlarged.

Dental formula: I. $\frac{2-2}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{1-1}{2-2}$, M. $\frac{3-3}{3-3}=32$.

Eptesicus fuscus (BEAUVOIS).

BROWN BAT. LARGE BROWN BAT.

Vespertilio fuscus BEAUVOIS, Catal. Peale's Mus. Phila., 1796, p. 14. MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan). MILLER, N. Amer. Fauna, No. 13, 1897, p. 98 (Illinois, Missouri). ADAMS, Rept. State Board Geol. Surv. Mich., 1908 (1909), p. 390 (Isle Royale, Michigan).

Adelonycteris fuscus EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 134 (Indiana). RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 204 (Tennessee).

Scotophilus fuscus STRONG, Geol. Wis., Surv. 1873-79, I, 1883, p. 438 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 33 (Minnesota).

Eptesicus fuscus MILLER, Bull. U. S. Nat. Mus., No. 57, 1907, p. 208. HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 631 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 68 (Tennessee).

Eptesicus melanops WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 596 (Illinois).

Eptesicus fuscus fuscus WARD, Bull. Wis. Nat. Hist. Soc., VIII, 1910, p. 180 (Wisconsin).

Type locality — Philadelphia, Pennsylvania.

Distribution — Greater portion of the United States and southern Canada, from the Atlantic to the Pacific, except the southern parts of the Gulf states where it is replaced by a slightly different form.

Description — Ears short and furred at base; tip of tail extending slightly beyond interfemoral membrane; wings and interfemoral membrane naked; general color of body sepia brown, paler on under parts, the back often showing a tinge of yellowish or cinnamon; fur when rubbed showing darker brown at base; number of teeth in upper jaw 14.

Measurements — Total length, about 4.40 in. (111.6 mm.); tail, 1.62 in. (41 mm.); foot, .40 in. (10 mm.).

The range of the Brown Bat includes the whole of Illinois and Wisconsin, and, while there is little doubt that it occurs in more or less numbers throughout both states, actual records are few. It is found in Indiana (Hahn); Missouri (Miller); and is reported from Minnesota by Herrick. The Milwaukee Public Museum collection contains seven specimens of this species from Milwaukee, which are all that are known to have been taken in Wisconsin. For Illinois, Miller records it from Richland and Hancock counties (*l. c.*, p. 97), and Wood reports two specimens from Urbana, Champaign County,— a very meagre list for a species which in 1893 Dr. Harrison Allen considered to be "probably the most common species of any in the United States."

The Brown Bat, so far as known, differs but little in habits from those of our other species, except that according to Hahn in Indiana it does not have the same partiality for caves, comparatively few being found in such places (*l. c.*, p. 633). They are strictly insectivorous and the good they do may be judged from the statement of Dr. R. W. Shufeldt who says: "They drink a good deal and have simply enormous appetites. One specimen, in the course of a single night, consumed 21 June-bugs (*Lachnosterna fusca*), leaving only a few legs and the hard outside wing-sheaths."*

While some individuals may migrate southward more or less at the approach of cold weather, a considerable number at least remain in the North and hibernate. Ward records specimens taken in Milwaukee between December 18 and February 6 (*l. c.*, 1910, p. 181); and Seton mentions a specimen found dormant at Ottawa, Canada, December 3, 1894.†

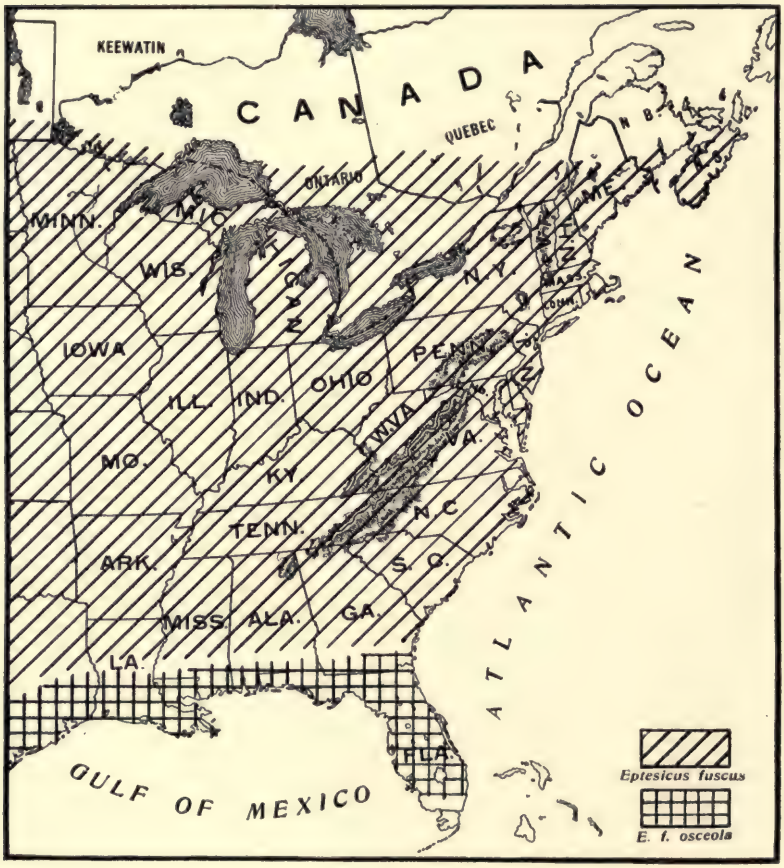
* Chapters, Nat. Hist. United States, 1897, p. 440.

† Life Histories of Northern Animals, II, 1909, p. 1182.

The Field Museum collection contains specimens of this species from Arkansas, Kentucky and Louisiana, but none from Illinois and Wisconsin.

Specimens examined from Wisconsin:

Wisconsin — (M. P. M.) Prairie du Sac, Sauk Co., 1; Fountain City, Buffalo Co., 2=3.



Map showing approximate distribution of the Brown Bat (*Eptesicus fuscus*) and its southern race (*E. f. osceola*) in eastern North America.

Eptesicus fuscus (BEAUVOIS). Type locality — Philadelphia, Pennsylvania. Description as previously given.

Eptesicus f. osceola RHOADS. (Proc. Acad. Nat. Sci. Phila., 1901, p. 618.) Type locality — Tarpon Springs, Hillsboro Co., Florida. Similar in size to *fuscus*, but color more cinnamon brown.

Genus **NYCTERIS** Borkhausen.

Nycteris Borkh., Der Zoöl. (Comp. Bibliothek gemein. Kennt. f. a. Stände, Pt. XXI), IV–VII, 1797, p. 66. Type *Vespertilio noveboracensis* Erxleben. Miller, Proc. Biol. Soc. Wash., XXII, 1909, p. 90.

Lasiurus Gray, Zoöl. Miscel., No. 1, 1831, p. 38.

Ears broad and rounded; upper surface of interfemoral membrane covered with fur (except on the extreme edge).

Dental formula: I. $\frac{1-1}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{2-2}{2-2}$, M. $\frac{3-3}{3-3}$, = 32.

This genus and *Nycticeius* are the only ones of our genera, the members of which have but 2 front teeth (incisors) between the canines in the upper jaw; the others have 4.

Nycteris borealis (MÜLLER).

RED BAT.

Vespertilio borealis MÜLLER, Natursyst., Suppl., 1776, p. 21.

Vespertilio Noveboracensis LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 337 (Wisconsin).

Vespertillio Noveboracensis KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54, 1855, p. 577 (Cook Co., Illinois).

Vespertilio noveboracensis MILES, Rept. Geol. Surv. Mich., I, 1860 (1861), p. 219 (Michigan).

Atalapha noveboracensis H. ALLEN, Bull. U. S. Nat. Mus., No. 43, 1893, p. 153 (Illinois, Wisconsin, Michigan). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 134 (Indiana).

Atalapha borealis RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 203 (Tennessee).

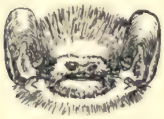
Lasiurus noveboracensis ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). STRONG, Geol. Wis., Surv. 1873–79, I, 1883, p. 438 (Wisconsin). HERRICK, Geol. & Nat. Hist. Surv. Minn., Bull. No. 7, 1892, p. 28 (Minnesota).

Lasiurus borealis MILLER, N. Amer. Fauna, No. 13, 1897, p. 108 (Illinois, Kentucky, Missouri, etc.). SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 125 (Wisconsin). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 33 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 634 (Indiana). HOWELL, Proc. Biol. Soc. Wash., XXII, 1909, p. 68 (Tennessee). *Ib.*, XXIII, 1910, p. 33 (Illinois, Kentucky). WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 597 (Illinois). N. A. WOOD, 13th Rept. Mich. Acad. Sci., 1911, p. 134 (Charity Islands, Saginaw Bay, Michigan).

Type locality — New York.

Distribution — North America, from the Rocky Mountains to the Atlantic coast, north to Quebec, Manitoba and Keewatin, and south to the Gulf states, where it is replaced by a slightly different form.

Description — Upper front teeth (incisors) between canines, 2; whole of upper surface of interfemoral membrane furred, except on extreme edge; tragus somewhat triangular in outline, with a slight concavity on anterior border just below the tip; general color varying from bright reddish brown to yellowish or yellowish red; a small whitish patch in front of the shoulder.



Measurements — Total length, about 4.25 in. (108 mm.); tail, 2 in. (51 mm.); foot, .33 in. (8 mm.).

The Red Bat is found throughout Illinois and Wisconsin and is one of our most common species. There are specimens in the Field Museum collection from Olive Branch (Alexander Co.), Willow Springs, Chicago, and Maywood, Illinois; and from Beaver Dam, Dodge Co., Wisconsin. Miller records it from Mount Carmel, Olney, Warsaw and West Northfield, Illinois (*l. c.*, p. 108); Wood considers it the most common Bat in the vicinity of Urbana, Champaign Co. (*l. c.*, p. 597). Wisconsin specimens are preserved in the Milwaukee Public Museum collection from Milwaukee, Walworth and Rock counties. Snyder states that it is abundant at Beaver Dam, Dodge Co.; and I am satisfied that a number of Bats seen by me flying about the houses at Woodruff, Vilas Co., in July, 1908, were this species, although no specimens were taken.

The Red Bat usually makes its home in hollow trees and there is little reason to doubt that it occasionally at least resorts to caves, although this is denied by some writers. Hahn, who has had extensive acquaintance with the cave fauna of Indiana and Kentucky, states that, while he has never met with a live one in caves, he found some 200 skulls of this species in Shawnee cave at Mitchell (*l. c.*, p. 635), which would seem to be almost conclusive evidence of their presence there in the past.

According to various authorities the young are born in May and number from 1 to 4.

Specimens examined from Illinois and Wisconsin:

Illinois — Olive Branch, Alexander Co., 3; Chicago, 9; Willow Springs, 1; Maywood, 1 = 14.

Wisconsin — Beaver Dam, Dodge Co., 3; (M. P. M.) Milwaukee, 20; Delavan, Walworth Co., 1; Milton, Rock Co., 1; Janesville, Rock Co., 3 = 28.

Map illustrating the probable distribution of the Red Bat (*Nycteris borealis*) and the southern subspecies (*N. b. seminolus*) in eastern North America.

Nycteris borealis (MÜLLER). Type locality — New York. Description as previously given.

Nycteris b. seminolus (RHOADS). (Proc. Acad. Nat. Sci. Phila., 1895, p. 32.) Type locality — Tarpon Springs, Hillsboro Co., Florida. Similar to *borealis*, but general color mahogany brown.

Nycteris cinereus (BEAUVOIS).

HOARY BAT.

Vespertilio cinereus BEAUVOIS, Catal. Peale's Mus. Phila., 1796, p. 15.

Vespertilio pruinosus LAPHAM, Trans. Wis. State Agr. Soc., II, 1852 (1853), p. 337 (Wisconsin).

Vespertillio pruinosus KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–54 (1855), p. 577 (Cook Co., Illinois).

Atalapha cinerea H. ALLEN, Bull. U. S. Nat. Mus., No. 43, 1893, p. 162 (St. Louis, Missouri). EVERMANN & BUTLER, Proc. Ind. Acad. Sci., 1893 (1894), p. 135 (Indiana).

Lasiurus cinerea SNYDER, Bull. Wis. Nat. Hist. Soc., II, 1902, p. 125 (Wisconsin).

Lasiurus cinereus ALLEN, Proc. Bost. Soc. Nat. Hist., XIII, 1869 (1871), p. 187 (Iowa). MILLER, N. Amer. Fauna, No. 13, 1897, p. 114 (Illinois, Minnesota, etc.). ADAMS, Rept. State Board Geol. Surv. Mich., 1905 (1906), p. 31 (Michigan). JACKSON, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 33 (Wisconsin). HOLLISTER, Bull. Wis. Nat. Hist. Soc., VI, 1908, p. 142 (Wisconsin). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 637 (Indiana). WOOD Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 599 (Illinois).

Type locality — Philadelphia, Pennsylvania.

Distribution — Practically the whole of North America south of Hudson Bay and the Great Slave Lake region.

Description — Color of body hoary (brown mixed with whitish); upper surface of interfemoral membrane covered with fur except on the extreme edge; forehead and band across the throat buff color, bordered below by blackish; edge of ears black; muzzle blackish, a narrow black stripe extending above the eyes.

Measurements — Total length, about 5.30 in. (130 to 140 mm.); tail, 2.12 in. (54 mm.); foot, .40 in. (10 mm.); extent (spread of wing in fresh specimens) 15.75 in. (400 mm.); forearm, about 2 in. (50 mm. or more).

The color is somewhat variable, but its brown color frosted with white (not reddish or yellowish red as in *N. borealis*) and larger size will distinguish it from that species, and the completely furred interfemoral membrane from other species which occur within our limits.

The Hoary Bat, while apparently by no means common, occurs throughout Illinois and Wisconsin. There are specimens in the Field Museum collection taken in Chicago and I have examined a specimen taken by Mr. T. L. Atkinson at Charleston, Coles Co. Miller records it from Warsaw, Hancock Co.; and Wood includes it in his Mammals of Champaign Co., Illinois. I have secured a specimen September 5, 1910, at Lake Geneva, Walworth Co., Wisconsin, and have examined specimens from Rock and Milwaukee counties of that state. Hollister records one from Delavan, Walworth Co.; Snyder, one from Dodge County; and Jackson, from Janesville and Milton, Rock Co.

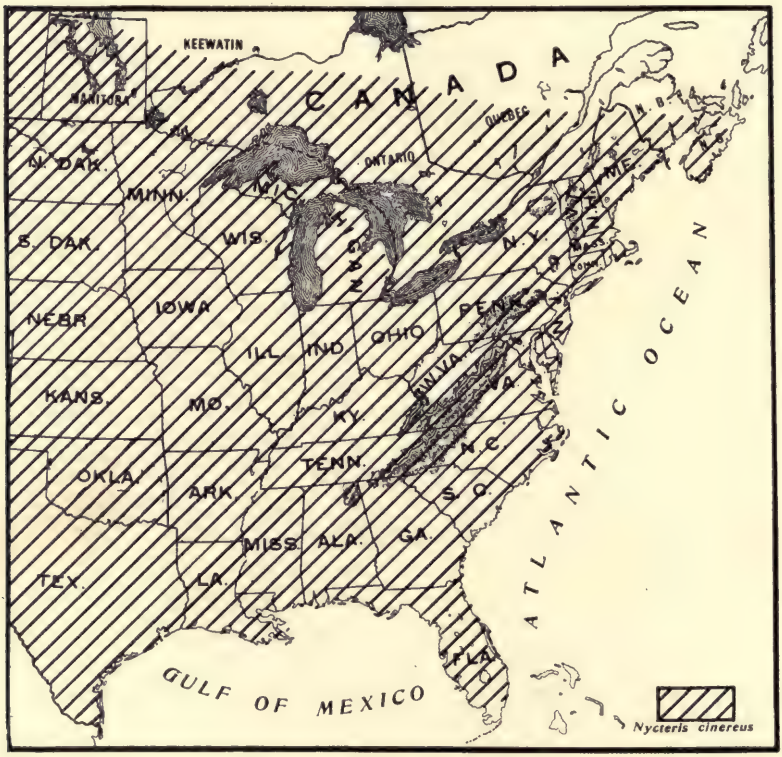
Although not as yet recorded from northern Wisconsin or southern Illinois, specimens have been taken in Minnesota (Miller), Michigan (Adams), Iowa (Allen), Indiana (Hahn), and Missouri (H. Allen).

This large Bat probably occurs most commonly in Illinois in spring and fall during the migrations, as most of them are supposed to breed from southern Wisconsin northward. That at least a few individuals

remain with us during the breeding season is proved by the fact that Hahn records a female with two young, having been taken in June in southern Indiana (*l. c.*, p. 638). The young are born late in May or early in June and number from 2 to 4.

The power of flight in Bats is illustrated by the occasional occurrence of this species in Bermuda.* To reach there they were forced to make a continuous flight of nearly 600 miles from the nearest land.

Specimens examined from Illinois and Wisconsin:
Illinois — Chicago, 3; (O.) Charleston, Coles Co., 1 = 4.
Wisconsin — Lake Geneva, Walworth Co., 1; (M. P. M.) Janesville, Rock Co., 4; Milwaukee, 2 = 7.



Map showing approximate range of the Hoary Bat (*Nycteris cinereus*) in eastern North America. Its range includes practically the whole of North America from the Atlantic to the Pacific, south of Hudson Bay and the Great Slave Lake region.

* Jones, Mamm. of Bermuda. (Bull. U. S. Nat. Mus., 1884, p. 145.)

Genus **NYCTICEIUS** Rafinesque.

Nycticeius Rafinesque, Journ. de Physique, LXXXVIII, 1819, p. 417.
Type *Vespertilio humeralis* Rafinesque.

"Upper incisor distinctly separated from canine; lower incisors scarcely crowded; outer lower incisor tricuspidate and not smaller than others; skull low and narrow; uropatagium furred at extreme base only; tragus blunt and bent forward; tip of tail free from membrane; mammæ 2." (Miller, *l. c.*, p. 118.)

Dental formula: I. $\frac{1-1}{3-3}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{1-1}{2-2}$, M. $\frac{3-3}{3-3}=30$.

Nycticeius humeralis (RAFINESQUE).

RAFINESQUE BAT.

Vespertilio humeralis RAFINESQUE, Amer. Month. Mag., III. 1818, p. 445.
N [ycticeius] humeralis RAFINESQUE, Journ. de Physique, LXXXVIII, 1819, p. 417.
Nycticejus humeralis RHOADS, Proc. Acad. Nat. Sci. Phila., 1896 (1897), p. 204 (Tennessee).
Nycticejus crepuscularis TRUE, Proc. U. S. Nat. Mus., VII, 1884 (1885), p. 602.
Nycticeius humeralis MILLER, N. Amer. Fauna, No. 13, 1897, p. 118 (Kentucky, etc.). HAHN, Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 649. WOOD, Bull. Ill. State Lab. Nat. Hist., VIII, 1910, p. 600 (Illinois). HOWELL, Proc. Biol. Soc. Wash., XXIII, 1910, p. 33 (Illinois, Kentucky).

Type locality — Kentucky.

Distribution — Southern United States, north to Pennsylvania and Illinois and west to Nebraska and Texas.

Description — Upper front teeth (incisors) between canines 2; *tip of tail extending slightly beyond interfemoral membrane;* general color dull umber brown above, paler below; fur decidedly darker at base; general color somewhat variable, the color of the upper parts occasionally approaching sepia brown; ears rather small, thick and leathery; tragus short and not sharp pointed.

Measurements — Total length, about 3.65 in. (92 mm.); tail, 1.40 in. (35 mm.); foot, .40 in. (10 mm.); expanse, about 9.50 in.

So far as known, the range of the Rafinesque Bat within our limits is restricted to about the southern two-thirds of Illinois. There are specimens in the Field Museum collection from Olive Branch, Alexander Co.; and Howell records it from that locality; Wood states that it is not rare in Champaign County (*l. c.*, p. 600), which is the most northern record we have for the state.

Specimens examined from Illinois:
Illinois — Olive Branch, Alexander Co., 11, (5 in alcohol) = 11.

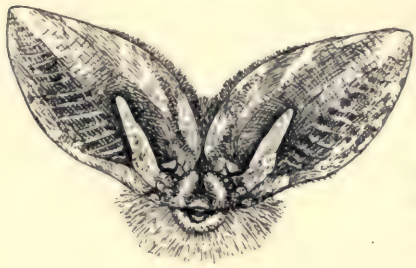
Map showing approximate range of the Rafinesque Bat (*Nycticeius humeralis*) in the United States.

Corynorhinus macrotis (LECONTE), BIG-EARED BAT. The Big-eared Bat has not been recorded from within our limits, but it is not unlikely that it occurs in Illinois and it should be carefully looked for in the caves along the Wabash River in Hardin and Polk counties in the extreme southeastern portion of the state. In Indiana it has been recorded from Greencastle, Putnam Co.;* and Mitchell, Lawrence Co.;† and Hahn states he saw six individuals in the caves at the latter place during the winter of 1906–07 and secured two specimens.‡

The species may readily be distinguished from our other Bats by its huge ears which measure an inch or more in length. The gen-

* Butler, Proc. Ind. Acad. Sci., 1894 (1895), p. 86.
† McAtee, Proc. Biol. Soc. Wash., XX, 1907, p. 7.
‡ Ann. Rept. Dept. Geol. & Nat. Resources Ind., 1908 (1909), p. 619.

eral color of this Bat is pale sepia brown, or yellowish brown, the fur darker at the base; the belly is grayish white. The tail does not extend beyond the interfemoral membrane. Total length, about 4 in. (105 mm.); tail vertebræ, about 2 in. (50 mm.); forearm, about 1.60 in. (41 mm.); ear, about 1.20 in. (30 mm.).

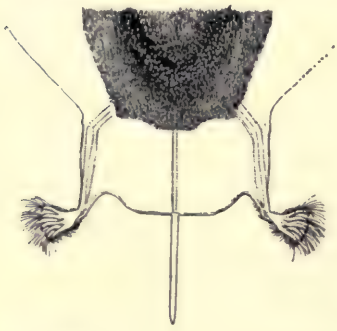


Big-eared Bat.

The range of the Big-eared Bat is restricted, so far as known, to southeastern United States, the type locality being Georgia.

Family MOLOSSIDÆ.

Nyctinomus depressus (WARD),* FREE-TAILED BAT. It is not unlikely that stragglers belonging to this species may occur in Illinois; a specimen was found dead in Central Park, Cedar Rapids, Iowa, in the fall of 1910, which was secured by Dr. B. H. Bailey who kindly sent it to me for examination. It may readily be distinguished from others of our Bats by the character of the tail, the free portion of which extends about an inch beyond the interfemoral membrane. Other characters which will aid in its identification are, ears large and apparently united; general color very dark umber brown. Measurements (from dried skin), total length, about 4.50 in. (115 mm.); total length of tail vertebræ, about 1.65 in. (42 mm.); length of free portion of tail vertebræ, about .90 in. (23 mm.); length of forearm, 2.40 in. (61 mm.); height of ear about .65 in. (16.5 mm.) The occurrence of this Bat in eastern Iowa greatly extends its previously known range. Specimens of this wandering Mexican species have been taken in California, Arizona, Colorado and Nevada.† Another and quite different species belonging to this genus (*Nyctinomus mexicanus*) is common in Florida and the Gulf states.



* Ward, American Naturalist, XXV, 1891, p. 747. Type locality—Tacubaya, City of Mexico.

† Mr. Gerrit S. Miller, Jr. considers the specimen taken in Nevada and described by H. Allen as *Nyctinomus macrotis nevadensis* (Monog. Bats N. Amer., 1893, p. 171) to be this species. (See Proc. Biol. Soc. Wash., XV, 1902, p. 250.)

Order PRIMATES.

MAN, APES, MONKEYS, ETC.

This order comprises two living suborders: Lemuroidea containing the Lemurs; and Anthropoidea, which includes the Monkeys, Apes and Man. With the exception of the last no representative of the order occurs within our limits,* but Man has existed in North America since a very early period and it is obvious, from a zoölogical standpoint, should be included in a faunal list of the mammals of this region. With the exception of Man all the members of the order are nearly or quite covered with hair and are generally arboreal in habits. The nails are flattened (except in the Lemurs and Marmosets) and the hands are adapted for grasping, as are also the feet to a more or less degree, as (except in Man) the hallux or big toe is opposable to the digits. The orbits of the skull are surrounded by bone and the orbital and temporal vacuities are at least partly separated. Clavicles are always present; the scaphoid and lunar of the carpus are distinct; the humerus lacks the entepicondylar foramen and the femur a third trochanter. The stomach is usually simple, being sacculated only in the largely vegetarian subfamily *Semnopithecinæ;* a cæcum is present and large. The mammæ are usually thoracic, always so except in some Lemurs, where they are also abdominal. Tail varying from very long, as in some of the Monkeys, to entirely absent in the higher Apes (*Simiidæ*) and Man.

Suborder ANTHROPOIDEA.

The Anthropoidea are divided into five families, two of which, *Hapalidæ*, the Marmosets, and *Cebidæ*, the American Monkeys, are confined to the New World; while the members of the *Cercopthecidæ*, the Macaques, Baboons, etc., and *Simiidæ*, which includes the Gibbons, Ourangs, Chimpanzees, and Gorillas, are all Old World forms. The fifth family, *Hominidæ*, Man, contains but one living genus†, *Homo*,

* Fossil remains of Monkeys and Lemurine mammals have been found in Wyoming. (See Wortman, Amer. Journ. Sci., XV, 1903, p. 191; and Osborn, The Age of Mammals, 1910, p. 134.)

† Authorities differ as to whether the fossil genus *Pithecanthropus* belongs to this family or to the *Simiidæ*. Osborn places it in the *Hominidæ* (*l. c.*, p. 545).

and one species, *H. sapiens*, which is represented by various races in different parts of the World.

The principle characters which distinguish the families belonging to the Anthropoidea from their nearest allies, the Lemuroidea, may briefly be summarized as follows:

Orbit of skull largely separated from the temporal fossa by a plate of bone; lachrymal foramen situated inside the margin of the orbit instead of outside; upper incisors without diastemata (gaps between the teeth); second digit of hand well developed and second digit of foot with flattened nail, except in the Marmosets (*Hapalidæ*); cerebral hemispheres highly developed and nearly or quite concealing the cerebellum; uterus not bicornate; placenta discoidal and deciduate; mammæ always thoracic, never abdominal.

Family HOMINIDÆ. Man.

Aside from the supposed distinctive psychological characters attributed to members of this family, the following are the most important anatomical differences which distinguish Man from the highest Apes: Size and shape of the non-opposable hallux (which aids in assuming an upright position in walking); relative shortness of the arms; 12 rib-bearing vertebræ; thumb relatively larger and with greater mobility; skull rounded and smooth (not ridged as in the Apes) and face less projecting; cerebral hemispheres greatly developed; absence of projecting canines, etc. Various other characters, such as the usual absence of the scansorius muscle and the rudimentary character of the ear muscles, are often cited, but the occasional presence of the former and functional activity of the latter greatly detract from their value. The same may be said of the apparent absence of hair on the greater portion of the human body, as many abnormalities occur, and in any event the difference is evidently only in extent of development.

There is no such development of the larynx in the human species as is shown in the large throat pouches of various Anthropoids; and as Beddard remarks, "The minute diverticula of that organ, known to human anatomists as the ventricles of Morgagni, alone remain to testify to the former howling apparatus in the ancestors of Man."*

This does not necessarily imply that the original type of mammal from which the modern races of men have sprung was an Ape. That both Man and Ape are descended from a common ancestor has strong arguments in its favor, but we do not know what that ancestor was like.

* Mammalia, London, 1902, p. 589.

It is possible, as Prof. Haeckel suggests, that it has been found in *Pithecanthropus*,* the fossil fragments of which were discovered in Java, but the problem has not as yet been solved and perhaps the answer will always be, "We do not know."

Genus **HOMO** Linn.

Homo Linnæus, Syst. Nat., X ed., I, 1758, p. 20. Type *Homo sapiens* Linn.

Dental formula: I. $\frac{2-2}{2-2}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{2-2}{2-2}$, M. $\frac{3-3}{3-3} = 32$.

Homo sapiens americanus (LINN).

AMERICAN INDIAN.

[*Homo sapiens*] *Americanus* Linn., Syst. Nat., X ed., 1758, p. 20. *Type locality* — America.

The supposed origin and antiquity of Man in this region will not be discussed here, as the subject is beyond the scope of this work.

* The Last Link, London, 1898.

APPENDIX.

SOME ANIMALS OF THE PAST.

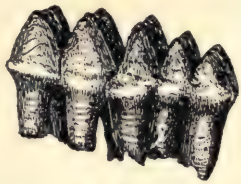
While it is not my intention to include fossil species in the present work, it seems desirable to refer briefly to some of them which are known to have inhabited this region in past ages, especially as, in the case of the Proboscidians (huge elephant-like beasts), the teeth and bones, which are found from time to time within our limits, are of such great size as to excite curiosity as to their origin. It is hardly necessary to state, however, that my remarks are here designed merely as an introduction to the subject.

During what is known as the Pleistocene Epoch, a period of time of vast antiquity although comparatively recent from the standpoint of the geologist, enormous numbers of strange mammals existed in North America. Elephants and Mastodons were very numerous, as well as Giant Sloths (*Megalonyx*), Camels, Llamas, Bison, peculiar Horses, Cats as large as a modern Tiger, Sabre-tooths (members of the Cat family having enormously developed canines), a huge Beaver-like animal (*Castoroides*) as large as a Bear, and a host of others large and small. By no means all of these animals are known to have inhabited this region, but many of them undoubtedly did, together with other strange creatures of which we know nothing. Bones of Mastodons and Mammoths, however, have frequently been found in Illinois and Wisconsin. Those of a Mammoth were discovered while excavating a sewer in the city of Milwaukee; and Mastodon remains have been found in many places, including at least two localities (Evanston and Glencoe) in Cook Co., Illinois. In a carefully prepared paper Miss Netta C. Anderson records the finding of remains of these huge Proboscidians in 26 counties in Illinois.* It is stated that a tusk of a Mastodon dug up east of Illiopolis, Sangamon County, measured 9 feet in length and about 2 feet in circumference at the larger end; and a molar tooth found in Calhoun County is claimed to have weighed nearly 18 pounds. These animals did not differ greatly in size from Elephants of the present day.

During the past century a number of bodies of Mammoths have been found in Siberia in a frozen state embedded in ice or soil where they

* A preliminary List of fossil Mastodon and Mammoth Remains in Illinois and Iowa. Augustana Library Pub., Rock Island, Ill., No. 5, 1905, pp. 1–43.

Molar tooth of *Mastodon americanus*,*
American Mastodon.
(About ⅛ nat. size.)



Molar tooth of *Elephas primigenius*,
Northern Mammoth.
(About ⅛ nat. size.)

had been preserved for ages, some of them in nearly perfect condition. In 1799 the body of a Mammoth, *E. primigenius*, was found frozen in the ice in the estuary of the Lena River, Siberia. It was in such a good state of preservation that it is claimed some of its flesh was eaten by the men who discovered it. Unfortunately, however, the carcass was almost destroyed by wolves and bears before the remains were ultimately secured and taken to St. Petersburg, where the skeleton and some of the hide are preserved. Unlike the modern Elephant, these animals were covered with long, brown hair mixed with longer, black hairs, and had a shaggy mane.

In 1901 another frozen specimen was discovered near Beresovka, Siberia, which was practically complete; but much of the hair was lost in excavating it. The animal was saved and mounted and is now on exhibition in the museum at St. Petersburg.

We have reason to believe that species belonging to this order existed in North America at a comparatively recent date and were not unlikely contemporaneous with primitive man. It is interesting to note that some Indian tribes have traditions that the huge bones of these animals belonged to "Fathers of Oxen," beasts that lived in ancient times together with a giant race of men.

Those who desire further information concerning our fossil species are referred to such well known publications as: Extinct Monsters, by H. N. Hutchinson, New York, 1892; Creatures of Other Days, by H. N. Hutchinson, New York, 1894; Manual of Geology, by J. A. Dana, 4th ed., 1895; Animals of the Past, by F. C. Lucas, New York, 1901, and other works by the same author; The Evolution of the Elephant, by Richard S. Lull, Amer. Journ. Sci., March, 1908; and The Age of Mammals in Europe, Asia and North America, by H. F. Osborn, New York, 1910.

* Cuvier's name of *Mastodon* for this genus must give place to *Mammut* of Blumenbach but the change here might be misleading.

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GLOSSARY.

Allantoic — A membranous sac-like appendage for effecting oxygenation and other changes in the blood, developed from the posterior part of the alimentary tract in the embryos of mammals and other vertebrates.

Anchylose — To grow together; to unite and become immovable.

Alisphenoid — Pertaining to the greater wings of the sphenoid bone.

Alveola — A pit or cavity; as the socket of a tooth.

Arboreal — Tree dwelling.

Antorbital foramen — Infraorbital foramen.

Audital bulla (see Bulla).

Axilla — Hollow space between junction of the arm and shoulder; armpit.

Basal length (of skull) — Distance from lower edge of *foramen magnum* to extreme end of premaxillary in front of incisors.

Basilar length of Hensel (of skull) — Distance from lower edge of *foramen magnum* to the posterior alveola border of a middle incisor.

Bicolor — Having two colors.

Bicuspid — With two cusps.

Bifid — Divided into two parts.

Brachydont — Having a low or short crown.

Brain case — The part of the skull enclosing the brain.

Bulla, pl. bullæ — The swollen portion of the bony part of the external meatus of the ear; see chart, p. 12.

Cæcum — A sac or pouch open only at one end, which is situated at the junction of the large and small intestines; see page 22.

Canine teeth — See chart, p. 11.

Carnassial teeth — See chart, p. 14.

Calcar — A bony cartilage extending from the tarsus along the edge of the interfemoral membrane in bats.

Carnivorous — Flesh eating.

Carpus — Bones forming the wrist joint.

Caudal — Refers to the tail.

Cheek teeth — Teeth on side of jaw posterior to the canine.

Chironym — Unpublished or manuscript name.

Clavicle — The collar bone.

Cloaca — The common cavity into which the hind part of the alimentary canal as well as the urinary and generative ducts open.

Conch — The external ear.

Condyle — A protuberance on the end of bone forming a point of articulation with another bone.

Cortex — The part of a hair which surrounds the cellular center and which contains the color pigment.

Crepuscular — Active at twilight.

Cuticle — The epidermis or outer covering of the true skin; see skin.

Cusp — A point or protuberance on crown of tooth.

Deciduous — Periodically shed, not permanent; as, antlers of deer, which fall off annually or milk teeth, which are replaced by others.
Digitigrade — Walking on the toes.
Diphyodont — Having two successive sets of teeth.
Discoidal — Disk-shaped.
Diurnal — Active by day.
Dorsal — Refers to the back.
Epidermis — Outer layer of the skin; see skin.
Epiphysis — A cartilaginous part of a bone which ossifies separately and subsequently becomes anchylosed to the main part of the bone.
Foramen, pl. foramina — A hole or opening.
Fossa, pl. fossæ — A depression or cavity.
Fossorial — Burrowing.
Frugivorous — Fruit eating.
Hallux — First toe of hind foot; corresponds to big toe in man.
Heterodont — Having diversified teeth; as, molars, canines, and incisors.
Hibernate — To become torpid and remain for a certain length of time in a comatose condition.
Homonym — One and the same name for two or more different things.
Hypsodont — Applied to teeth having long crowns and short roots, such as the molars of the *Bovidæ*.
Incisors — Front teeth between canines; see chart, p. 12.
Inguinal — Pertaining to the groin.
Insectivorous — Insect eating.
Interfemoral — Between the thighs; used with reference to the membrane between the hind limbs of a bat.
Interorbital — Between the eyes.
Interorbital breadth — Breadth of interorbital constriction.
Jugal or malar bone — See chart, p. 12.
Lambdoidal ridge — A ridge on side of back portion of skull.
Mamma, pl. mammæ — A teat.
Mandible — The lower jaw.
Mastoid breadth — Distance between mastoid processes.
Meatus — Used here with reference to the opening of the ear.
Molars — The back cheek teeth; see chart, p. 11.
Monophyodont — Having only one set of teeth.
Nares — The nostrils.
Nocturnal — Active by night.
Nomen nudum or anonym — Name originally given to something without an accompanying diagnosis or a reference to an identifiable, published figure or plate.
Nucleated — Having a nucleus or nuclear substance.
Odontoblast — A tooth cell that produces dentine.
Omnivorous — Eating food of all kinds and indiscriminately.
Orbit — Eye socket.
Palatilar length — Distance from posterior end of palatine bone to posterior base of incisors.
Pectoral — Pertaining to the breast.
Pelage — The hair or fur.
Pencillated — Refers to tuft of long hairs extending beyond the end of the tail.

Pentadactylous — With five fingers or toes.

Placenta — The organ by which the fetus of the higher mammals is nourished. It is connected with the fetus on one side by the umbilical cord and on the other is attached to the walls of the uterus, from which it is detached at birth.

Plantar tubercles — Wart-like excrescences on under surface of foot.

Plantigrade — Walking on practically the whole sole of the foot.

Pollex — The thumb or first toe of front foot.

Postorbital — Behind the eye.

Premolars — Teeth in side of jaw between the molars and the canine.

Ramus, pl. rami — The ascending part of the lower jaw at the posterior end.

Rostrum — The part of the skull in front of the eyes, made up of the nasal and part of the premaxillary and maxillary bones; practically, the snout.

Sagittal crest — A bony ridge along the middle upper surface of the brain case in some mammals.

Sectorial — Adapted for cutting; usually used to describe certain teeth.

Septum — A partition.

Skin — Consists of two layers: an outer one termed the epidermis or cuticle (which has no blood vessels), beneath which is a second layer or true skin, variously called *dermis*, *corium* or *cutis vera*, which is abundantly supplied with nerves and blood-vessels. The skin covers the outer surface of the body and continues in a softer and somewhat modified form (termed mucous membrane) as a lining for the internal passages, such as the digestive and urogenital tracts.

Squamate — Scaly or covered with scales.

Squamosal bone — See chart, p. 11. Forms part of the temporal bone in man; what answers to the squamous portion in man is called the squamosal in lower animals.

Squamous — Covered with scales, scaly or resembling a scale.

Sulcate — Grooved.

Supraorbital — Expansion of bone above the eye, noticeable in the Hares and Rabbits.

Suture — Line of union or point of junction of two bones, which ultimately unite and become immovable.

Synonym — One of two or more names for one and the same thing.

Tactile — Pertaining to the sense of touch.

Tail vertebræ or caudal vertebræ — See page 10.

Tarsus — Bones forming the ankle joint. See chart, p. 10.

Tautonym — Binomial name, having generic and specific names alike.

Terrestrial — Living on the ground.

Thoracic — Used here as pertaining to the chest or thorax.

True skin — Inner portion of the skin known as dermis or corium or *cutis vera*.

Tooth row — Continuous row of teeth on side of jaw posterior to the canine (most commonly used in describing Rodents).

Topotype — A specimen collected in the exact locality where the original type was obtained.

Tragus, pl. tragi — An erect cartilaginous process in the conch or external ear of a bat.

Trochanter — One of the bony processes of the thigh bone.

Truncate — Blunt.

Tuberculate — Having tubercles or small projections; commonly used in this work in describing teeth.

Type [of genus] — The species which was originally designated or later selected in conformity with the rules of zoölogical nomenclature to typify a genus.

Type [of species] — The specimen upon which has been based the first recognizable description of the species or subspecies which conforms with the rules governing zoölogical nomenclature.

Type locality — The exact locality where the type of the species was collected.

Unicuspid — Having a single cusp or point.

Uropatagium — Interfemoral membrane; see interfemoral.

Vacuity — A vacant space or opening.

Ventral — Pertaining to the abdominal surface.

Zonary — Resembling a belt or girdle.

Zygoma or zygomatic arch — The bony arch of the cheek formed by the jugal or malar bone and the zygomatic process of the squamosal; see chart, p. 12.

Zygomatic breadth — Greatest distance between outer sides of zygomatic arches.

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COUNTIES OF ILLINOIS AND WISCONSIN

ALPHABETICALLY ARRANGED

ILLINOIS COUNTIES

Adams.	40	Ford.	26	Livingston.	27	Randolph.	83
Alexander.	102	Franklin.	85	Logan.	46	Richland.	76
Bond.	68	Fulton.	34	McDonough.	37	Rock Island.	15
Boone.	4	Gallatin.	92	McHenry.	5	St. Clair.	81
Brown.	42	Greene.	63	McLean.	28	Saline.	93
Bureau.	18	Grundy.	22	Macon.	56	Sangamon.	57
Calhoun.	62	Hamilton.	91	Macoupin.	65	Schuyler.	41
Carroll.	13	Hancock.	39	Madison.	67	Scott.	60
Cass.	43	Hardin.	99	Marion.	78	Shelby.	55
Champaign.	49	Henderson.	38	Marshall.	30	Stark.	31
Christian.	58	Henry.	17	Mason.	44	Stephenson.	2
Clark.	73	Iroquois.	25	Massac.	100	Tazewell.	33
Clay.	77	Jackson.	95	Menard.	45	Union.	96
Clinton.	79	Jasper.	71	Mercer.	16	Vermilion.	50
Coles.	53	Jefferson.	86	Monroe.	82	Wabash.	89
Cook.	7	Jersey.	64	Montgomery.	66	Warren.	36
Crawford.	74	Jo Daviess.	1	Morgan.	59	Washington.	80
Cumberland.	72	Johnson.	97	Moultrie.	54	Wayne.	87
Dekalb.	10	Kane.	9	Ogle.	11	White.	90
Dewitt.	47	Kankakee.	24	Peoria.	32	Whiteside.	14
Douglas.	52	Kendall.	21	Perry.	84	Will.	23
DuPage.	8	Knox.	35	Piatt.	48	Williamson.	94
Edgar.	51	Lake.	6	Pike.	61	Winnebago.	3
Edwards.	88	La Salle.	20	Pope.	98	Woodford.	29
Effingham.	70	Lawrence.	75	Pulaski.	101		
Fayette.	69	Lee.	12	Putnam.	19		

WISCONSIN COUNTIES

Adams.	43	Eau Claire.	32	Manitowoc.	50	St. Croix.	35
Apostle Isls.	7	Florence.	1	Marathon.	27	Sauk.	56
(See Ashland Co.)		Fond du Lac.	47	Marinette.	20	Sawyer.	12
Ashland.	7	Forest.	2	Marquette.	45	Shawano.	25
Barron.	14	Gates.	15	Milwaukee.	65	Sheboygan.	51
Bayfield.	8	Grant.	60	Monroe.	41	Taylor.	16
Brown.	23	Green.	70	Oconto.	19	Trempealeau.	38
Buffalo.	37	Green Lake.	46	Oneida.	4	Vernon.	58
Burnett.	10	Iowa.	61	Outagamie.	24	Vilas.	3
Calumet.	49	Iron.	6	Ozaukee.	52	Walworth.	68
Chippewa.	31	Jackson.	39	Pepin.	34	Washburn.	11
Clark.	30	Jefferson.	63	Pierce.	36	Washington.	53
Columbia.	55	Juneau.	42	Polk.	13	Waukesha.	64
Crawford.	59	Kenosha.	67	Portage.	28	Waupaca.	26
Dane.	62	Kewaunee.	22	Price.	5	Waushara.	44
Dodge.	54	La Crosse.	40	Racine.	66	Winnebago.	48
Door.	21	Lafayette.	71	Richland.	57	Wood.	29
Douglas.	9	Langlade.	18	Rock.	69		
Dunn.	33	Lincoln.	17	Rusk.	15		

ILLINOIS COUNTIES.

1. Jo Daviess.
2. Stevenson.
3. Winnebago.
4. Boone
5. McHenry.
6. Lake.
7. Cook.
8. DuPage.
9. Kane.
10. Dekalb.
11. Ogle.
12. Lee.
13. Carroll.
14. Whiteside.
15. Rock Island.
16. Mercer.
17. Henry.
18. Bureau.
19. Putnam.
20. La Salle.
21. Kendall.
22. Grundy.
23. Will.
24. Kankakee.
25. Iroquois.
26. Ford.
27. Livingston
28. McLean.
29. Woodford.
30. Marshall.
31. Stark.
32. Peoria.
33. Tazewell.
34. Fulton.
35. Knox.
36. Warren.
37. McDonough.
38. Henderson.
39. Hancock.
40. Adams.
41. Schuyler.
42. Brown.
43. Cass.
44. Mason.
45. Menard.
46. Logan.
47. Dewitt.
48. Piatt.
49. Champaign.
50. Vermilion.
51. Edgar.
52. Douglas.
53. Coles.
54. Moultrie.
55. Shelby.
56. Macon.
57. Sangamon
58. Christian.
59. Morgan.
60. Scott.
61. Pike.
62. Calhoun.
63. Greene.
64. Jersey.
65. Macoupin.
66. Montgomery.
67. Madison.
68. Bond.
69. Fayette.
70. Effingham.
71. Jasper.
72. Cumberland.
73. Clark.
74. Crawford.
75. Lawrence.
76. Richland.
77. Clay.
78. Marion.
79. Clinton.
80. Washington.
81. St. Clair.
82. Monroe.
83. Randolph.
84. Perry.
85. Franklin.
86. Jefferson.
87. Wayne.
88. Edwards.
89. Wabash.
90. White.
91. Hamilton.
92. Gallatin.
93. Saline.
94. Williamson.
95. Jackson.
96. Union.
97. Johnson.
98. Pope.
99. Hardin.
100. Massac.
101. Pulaski.
102. Alexander.

WISCONSIN COUNTIES.

1. Florence.
2. Forest.
3. Vilas.
4. Oneida.
5. Price.
6. Iron.
7. Ashland. (inc. Apostle Isls.)
8. Bayfield.
9. Douglas.
10. Burnett.
11. Washburn.
12. Sawyer.
13. Polk.
14. Barron.
15. Rusk or Gates.
16. Taylor.
17. Lincoln.
18. Langlade.
19. Oconto.
20. Marinette.
21. Door. (inc. islands).
22. Kewaunee.
23. Brown.
24. Outagamie.
25. Shawano.
26. Waupaca.
27. Marathon.
28. Portage.
29. Wood.
30. Clarke
31. Chippewa.
32. Eau Claire.
33. Dunn.
34. Pepin.
35. St. Croix.
36. Pierce
37. Buffalo.
38. Trempealeau.
39. Jackson.
40. La Crosse.
41. Monroe.
42. Juneau.
43. Adams.
44. Waushara.
45. Marquette.
46. Green Lake.
47. Fond du Lac.
48. Winnebago.
49. Calumet.
50. Manitowoc.
51. Sheboygan.
52. Ozaukee.
53. Washington.
54. Dodge.
55. Columbia.
56. Sauk.
57. Richland.
58. Vernon.
59. Crawford.
60. Grant.
61. Iowa.
62. Dane.
63. Jefferson.
64. Waukesha.
65. Milwaukee.
66. Racine.
67. Kenosha.
68. Walworth.
69. Rock.
70. Green.
71. Lafayette.

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